

RECENT OSTRACODES FROM CLIPPERTON ISLAND EASTERN TROPICAL PACIFIC

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ABSTRACT.—The Recent ostracode fauna of Clipperton Island is derived from several biogeographic regions. It includes: (1) new species of *Eucytherura*, *Neocaudites*, *Paradoxostoma*, and *Semicytherura*; (2) *Cytherelloidea praecipua*, *Occultocythereis angusta*, *Paracytheridea tschoppi* and species of *Triebelina* and *Bairdia* representing a distinct Caribbean aspect; (3) *Xestoleberis gracilis*, *Triebelina sertata*, *Sclerochilus* sp. nov., and *Bairdia ritugerda clippertonensis* subsp. nov. forming a weak Indopacific link; (4) a restricted west American aspect represented by *Bairdia semuvillosa* and *Mutilus convergens*; and, (5) a cosmopolitan aspect provided by the circumtropical species *Pseudocythere caudata*.

Clipperton Lagoon, open to the sea about 130 years ago, now supports a unique freshwater ostracode fauna consisting of new species of *Potamocypris*, *Cypridopsis* and *Limnocythere*.

Dominant species in the marine samples are *Paracytheridea tschoppi* and *Mutilus convergens*. Common associates of these are species of *Semicytherura*, *Paradoxostoma* and *Xestoleberis* in near-shore reef flat areas, and species of *Macrocyprina*, *Neocaudites*, and *Cytherelloidea* farther from shore. Members of the Family Loxoconchidae, characteristic of comparable Indopacific habitats, are conspicuously absent at Clipperton Island.

RESUMEN.—La fauna de Ostrácodos recientes de la isla Clipperton procede de varias regiones biogeográficas. Ahí aparecen los siguientes: 1) Especies nuevas de *Eucytherura*, *Neocaudites*, *Paradoxostoma* y *Semicytherura*; 2) *Cytherelloidea praecipua*, *Occultocythereis angusta*, *Paracytheridea tschoppi* y especies de *Triebelina* y *Bairdia* que presentan un distintivo aspecto Caribe; 3) *Xestoleberis gracilis*, *Triebelina sertata*, *Sclerochilus* sp. nov., y *Bairdia ritugerda clippertonensis* subsp. nov., que constituyen un débil eslabón Indo-Pacífico; 4) *Bairdia semuvillosa* y *Mutilus convergens* como representantes de las especies restringidas al oeste americano; y 5) la especie tropical *Pseudocythere caudata* como representante cosmopolita.

La comunicación de la laguna Clipperton con el Pacífico se abrió hace unos 130 años, y actualmente contiene una fauna excepcional de Ostrácodos dulceacuícolas, como son las especies nuevas de *Potamocypris*, *Cypridopsis* y *Limnocythere*.

Las especies dominantes en las muestras marinas son: *Paracytheridea tschoppi* y *Mutilus convergens*. Con éstas se encuentran comúnmente asociadas, especies de *Semicytherura*, *Paradoxostoma* y *Xestoleberis* en los arrecifes llanos próximos a la costa, y especies de *Macrocyprina*, *Neocaudites* y *Cytherelloidea* en regiones más alejadas. Es notable observar que los miembros de la Familia Loxoconchidae, característicos de habitats similares del Pacífico e Índico, están ausentes de la isla Clipperton.

INTRODUCTION

Clipperton Island, the easternmost Pacific atoll at latitude 10°18' N, longitude 109° 13' W (Figure 1), occupies a critical place in the scheme of tropical biogeography. It offers the only existing terrestrial, littoral, or sublittoral habitats along the Clipperton Fracture Zone (Menard and Fisher, 1958) or within the great tropical oceanic area known as the East Pacific Barrier (Ekman, 1953) that separates Polynesian and west North American shallow marine environments.

The atoll is oval in outline, about 3 by 4 km, and consists of a thin but unbroken ring of both loose and lithified coral debris with a single remnant of the igneous basement, Clipperton Rock (29 m high), at the atoll's southeastern edge. A deep and completely

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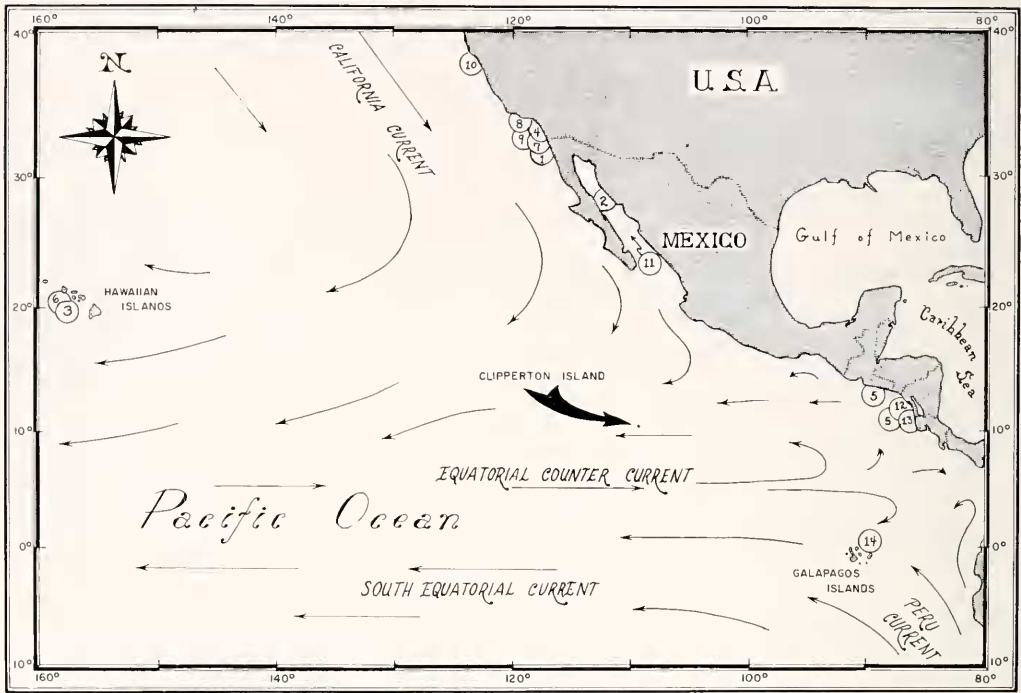


Figure 1. Clipperton Island and adjacent areas. Surface currents for February adapted from Sverdrup, Johnson and Fleming (1942). Previous published works dealing with podocypid and platycypid ostracodes in the east Pacific are numbered within a circle in the approximate area of study. These are (1) Benson, 1959, (2) Benson and Kaesler, 1963 (3) Brady, 1880, (4) Crouch, 1949, (5) Hartmann, 1953, 1957a, 1957b, 1959a, 1959b, (6) Holden, 1967, (7) Juday, 1907, (8) LeRoy, 1943, 1945, (9) Rothwell, 1948a, 1948b, (10) Skogsberg, 1928, 1950, (11) Swain, 1967, (12) Swain and Gilby, 1964, (13) Swain and Gunther, 1969, and (14) Triebel, 1954, 1956, 1957.

landlocked lagoon is fresh and generally palatable above 20 m but abruptly saline and stagnant below that depth (Sachet, 1962e). Early historical accounts of ocean connections (Sachet, 1963; Belcher, 1843) and *in situ* marine fossils, with a 370 ± 100 year radiometric age (Ferguson and Libby, 1962), indicate that the lagoon was at least periodically marine until recently.

The geologic age of Clipperton Island is unknown. But the low incidence of endemism among the marine invertebrates does not support an old age for the faunas.

On the other hand, the strong Caribbean character of the ostracode fauna supports the hypothesis that the Island has maintained a shallow water biota since the early Pliocene. Prior to that time a seaway extending through middle America linking the east Pacific with the Caribbean (Lloyd, 1963) would have allowed the North Atlantic Equatorial Current to sweep from east to west over the Colombian Basin into the Pacific at the latitude of Clipperton Island and could readily account for the Caribbean ostracode species now living there.

The marine invertebrate fauna is an impoverished one in terms of diversity. It is composed principally of central Pacific (Indopacific) and tropical west American (Panamic) species. Many of these species are known to have floating larval stages of long duration or to be potentially subject to dispersal by rafting. Indopacific and Panamic elements are almost equally represented in the inshore faunas, although the ratio of species

representative of these provinces varies somewhat from group to group. Mixtures of Indopacific and Panamic species in the shallow marine faunas of Clipperton Island mark a blending of these two biogeographic provinces which otherwise are clearly distinct (Hertlein and Emerson, 1953; Emerson, 1967). No modern Panamic species is known to have dispersed farther westward than Clipperton Island. A small group of Indopacific species which have crossed the East Pacific Barrier (Hertlein, 1937; Briggs, 1961; Emerson, 1967) is almost completely represented in Clipperton Island faunas, thus suggesting the islands role as a stepping stone. The failure of many other species to effect westward or eastward dispersals once having reached Clipperton Island is one of the great problems presented by that island and its faunas. Shifting Pacific North Equatorial (westward) and Equatorial Counter (eastward) surface currents (Figure 1) as well as subjacent currents, cross the eastern Pacific at the latitude of Clipperton Island, providing possibilities for faunal dispersal in both directions (Wyrtki, 1965; U. S. Navy Hydrographic Office, 1947, 1950, 1966).

The biogeographical importance of Clipperton Island, as well as the attraction of a remote and scarcely known island, inspired brief visits by biologists before 1956. Two expeditions with more ambitious aims were made possible in October-November 1956 and August-September 1958 through the participation of the University of California Scripps Institution of Oceanography in programs of the International Geophysical Year. The research vessel *Spencer F. Baird*, commanded by Captain Alan W. Phinney, provided transportation in both instances. The late Conrad Limbaugh served as scientific party chief for both expeditions. A single dredge haul from a subsequent S.I.O. cruise, locality B-8558, provided the only additional biological materials to which we have had access. Samples and field notes on which the present account of Clipperton Island ostracodes is based are the work of Allison who accompanied both the 1956 and 1958 expeditions. Sediment and algae samples which were the source of the ostracodes dealt with here, were collected by free and SCUBA diving by Allison and Limbaugh except for the dredge sample at station B-8558. The most comprehensive descriptions of the history, geography, geology, and biology of Clipperton Island are to be found in published works of Marie-Hélène Sachel (1960, 1962a, 1962b, 1963), who was one of the participants of the 1958 expedition.

FAUNAL CHARACTERISTICS OF THE OSTRACODA

The marine ostracode fauna of Clipperton Island, like those of the other marine invertebrates there, is impoverished but shows diverse biogeographic affinities. Nine species are described as new and are considered here as endemics. These may, in fact, reflect our poor knowledge of Pacific ostracodes. Areas from which eastern Pacific podocopid ostracodes have been described are shown in Figure 1.

The ostracode samples forming the basis of this account represent freshwater lagoon and various marine reef and off-reef habitats. Species distributions are outlined tentatively on the basis of six samples collected according to field evaluations of physical environmental factors and associated larger organisms. Species abundances, living-nonliving and distributional relationships are shown in Table 1.

Freshwater species. — *Cypridopsis oceanus* sp. nov., *Limnocythere viaticum* sp. nov., and *Potamocypris insularis* sp. nov., are abundant in Clipperton Lagoon. All presumably were introduced within the last 130 years after the last sea connections were blocked and marine conditions were replaced by the existing freshwater (Belcher, 1843). Only the unlikely possibility of prior introduction to, or evolution in, permanent ponds along the rim of the atoll, between the sea and the formerly marine lagoon, could account for a

freshwater ostracode history dating earlier than 130 years ago. It is unlikely that such ponds ever existed on the narrow rimmed atoll. The ostracodes probably were introduced by marine birds which frequent the island during their migratory flights.

Disarticulated valves of several marine species occur in the lagoonal samples and probably represent former marine conditions there. *Bairdia semuvillosa* appears to represent former marine conditions in the lagoon. It does not occur in existing marine habitats around the island, though it is reported living in a wide diversity of west American habitats (Benson, 1959; Swain, 1967) and would appear to tolerate a wide range of conditions.

Water in the lagoon varies in surface salinities from less than 0.1% to greater than 5.0%, depending on seasonal variations in rainfall (Sachet, 1962b). Below about 20 m the water is saline with abundant sulfides and without evidence of an invertebrate fauna.

Marine species. — Known distributions of the ostracodes which occupy the marine habitats give no clear indication of a dominant biogeographic relationship. *Eucytherura binocula*, *Mutilus convergens clippertonensis*, *Paradoxostoma limbaughi*, and *Semicytherura quadruplana* apparently represent an indigenous aspect of the Clipperton Island ostracode faunas.

Five species have Caribbean affinities, *Bairdia* sp., *Triebelina rugosa* (not *T. bradyi* in the sense of Puri, 1960), *Paracytheridea tschoppi*, *Occultocythereis angusta*, and *Cytherelloidea praecipua*. *Paracytheridea tschoppi* first appears in Miocene rocks of Trinidad, and is found living in the Caribbean and tropical eastern Pacific (Panamic province). Species of the genus *Occultocythereis* are common in early Tertiary deposits of North America and Europe (Morkhoven, 1963:197) and now occur in the Mediterranean (Muller, 1894), off the coast of Africa (Brady, 1911), and in the Caribbean. *Occultocythereis angusta*, described originally from Madeira Island, northwest Africa (Brady, 1911: "cythere deformis") also occurs in the Caribbean as far back as Miocene (Bold, 1963). Apart from its discovery at Clipperton Island, the genus *Occultocythereis* is unknown elsewhere in the Pacific. *Bairdia* sp. appears closely related to the undescribed Caribbean species *Bairdia* cf. *B. tuberculata* of Puri (1960). *Triebelina rugosa* and *Cytherelloidea praecipua* occur only in the modern Caribbean. *Neocaudites* is likewise a characteristic Caribbean genus (McKenzie, 1967), though we are aware of one species living off Dakar, Africa (unpublished), and two others (one fossil and one Recent) in the Hawaiian Islands (Holden, 1967). The Clipperton form, *N. pacifica pacifica* is considered subspecifically distinct from the living Hawaiian form, *N. p. minima*.

Indopacific and Panamic faunal aspects, clearly evident among associated Clipperton Island marine invertebrates, are weakly represented. *Xestoleberis gracilis*, *Sclerochilus* sp., and *Triebelina serata* may be Indopacific taxa, as might also *Bairdia ritugerda clippertonensis* subsp. nov. The absence of the Loxoconchidae is striking because one or more species of *Loxoconcha* and *Loxoconchella* are commonly represented in island faunas of the Indopacific. *Bairdia semuvillosa*, probably restricted to the extinct marine fauna of Clipperton Lagoon, provides the only evidence of a direct Panamic-Clipperton Island link. *Paracytheridea tschoppi* occurs in the Panamic Province but probably has its origin in the Caribbean.

Pseudocythere caudata is possibly a true cosmopolitan species. Other widely distributed species seem to be restricted to 2 or 3 provinces, as defined by other marine invertebrate groups.

Two species, *Mutilus convergens* and *Paracytheridea tschoppi*, dominate all of the marine samples, accounting for at least 50% of the individuals in each.

Living specimens of *Paradoxostoma limbaughi* and *Sclerochilus* sp. occur only on

intertidal and slightly subtidal (locality B-4241) areas of the reef flat. They belong to genera known to live on marine plants. *Xestoleberis gracilis* also seems to prefer littoral conditions but is represented by one living specimen and by several dead valves in deeper water. Brady (1890) described that species as living in reef and shore pools of the tropical Pacific.

Living specimens of *Semicytherura quadruplana* occur only in sample B-6100, just beyond the outer edge of the Clipperton reef flat, but associated species in the intermediate area between reef flat (B-4241) and deeper outer slope (B-6120) samples range variously shoreward and seaward.

Deeper habitats on the outer slope, beyond the outer edge of the "ten-fathom terrace" appear to be faunally distinguished by *Neocaudites pacifica* and *Cytherelloidea praecipua* living in association with abundant *Bairdia teeteri* and with the ubiquitous *Paracytheridea tschoppi* and *Mutilus convergens clippertonensis*. The deepest Clipperton sample, B-8558, at a depth of 92 m, lacks living ostracodes, although it contains numerous valves of species found living in shallower samples.

METHODS

Detailed descriptions are presented for (1) all new species, (2) those that have been inadequately described elsewhere, and (3) those of the Clipperton population that differ somewhat from other populations. The term "aff." is used here to indicate a close relationship between the Clipperton species and the species named. Whether they are conspecific or not is impossible to determine based on the available information. The use of "cf." denotes only a comparison to the species named and the two are probably distinct species.

Most primary (holotypes) and some secondary types (paratypes and hypotypes) are deposited in the collections of the U. S. National Museum (USNM), Washington, D. C., and some are in the collections of the San Diego Society of Natural History at the Museum of Natural History, San Diego, California (SDNH).

Measured specimens are adult instars unless otherwise indicated. Statistical measurements are computed at the 95 per cent confidence limits (\pm two standard deviations). All measurements are in microns (μ).

Clipperton Island Ostracode Localities

All samples (fig. 2) are assigned University of California Museum of Paleontology locality numbers. Most of the material, except ostracode types and minor parts of the samples, will be stored at the Edwin C. Allison Center for the Study of Pacific Faunas, San Diego State College.

B-4244 — West side freshwater lagoon; on fossil reefs and in surrounding calcareous sands; depth approximately 4 m.

B-4247 — West side freshwater lagoon; in sediment on steep slope off lagoon shelf; depth 8-10 m.

B-4241 — Reef flat off north side of island inshore from weakly developed algal ridge; on algae and in calcareous sediment between widely spaced coral heads (*Porites* and *Pocillopora*); depth intertidal to 1-1/2 m (in channels).

B-6100 — Approximately 100 m off outer edge of reef flat on north side of island; in sediment from broad sand patches near remains of sunken ships; depth 6-8 m.

B-6101 — Approximately 100 m off outer edge of reef flat on north side of island, opposite U.S.N.H.O. marker, about 30 m inshore from outer edge of most

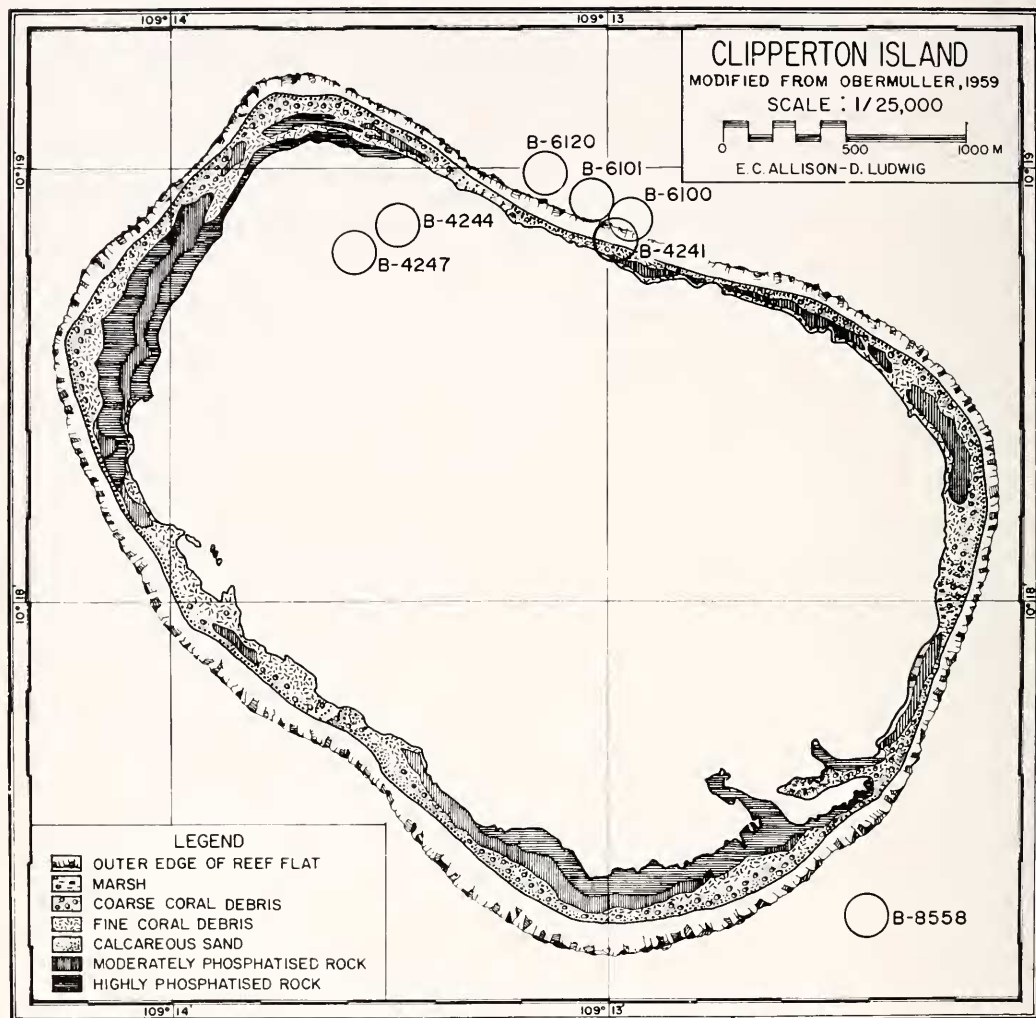


Figure 2. Clipperton Island station locations. Areas within circles indicate approximate station positions.

prominent submarine terrace, northwest of major sandy areas (B-6100); in small sediment pockets between and beneath massive living corals (mostly *Pavona*, *Porites*, and *Pocillopora*) which cover bottom; depth 10-12 m.

B-6120 = Steep slope off north side of island opposite west end of near breach in atoll margin (formed by waves during period between 1956 and 1958 expeditions), below slope break at outer edge of principal submarine terrace; in sediment between blocks of dead coral and sparse cover of living hermatypic coral; depth 40-45 m.

B-8558 = (CARR II 8 D) = Dredged living (ahermatypic) and dead coral debris and calcareous sand from slope off south-eastern side of Clipperton Island (10°19'N, 109°12'W); depth 92 m. Scripps Institution of Oceanography expedition CARROUSEL (R/V *Spencer F. Baird*), 11 August 1964.

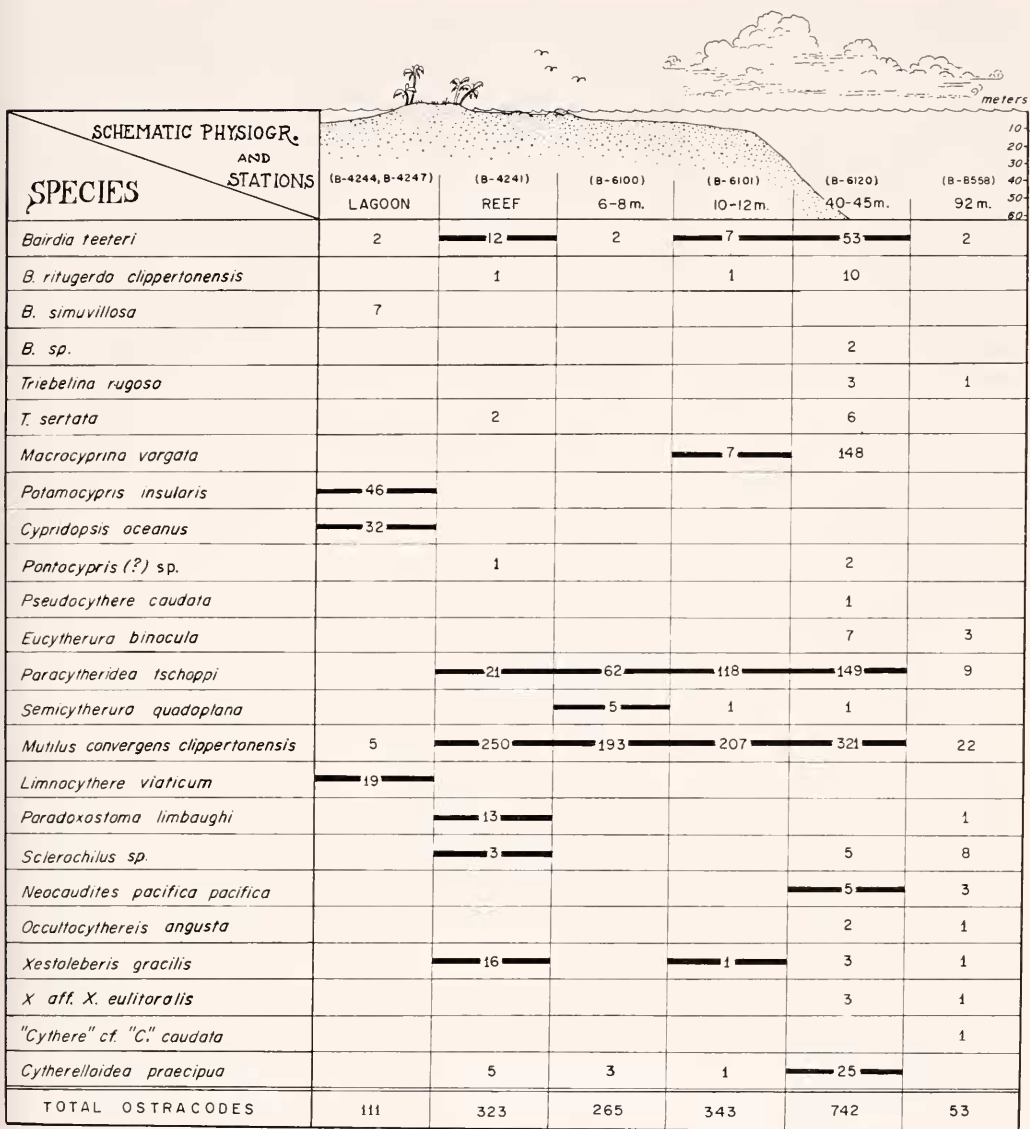


Table 1. Ostracode species-locality check list. Heavy lines indicate that some or all the individuals contained soft parts and are therefore inferred to have been living at that locality.

Order Podocopida Müller, 1894
 Suborder Podocopina Sars, 1866
 Superfamily Bairdiacea Sars, 1888
 Family Bairdiidae Sars, 1888
 Genus *Bairdia* McCoy, 1844
Bairdia simuvillosa Swain, 1967

Figure 3

Bairdia simuvillosa Swain, 1967:34, pl. 1, figs. 2a-f, 8; text figs. 30c-d, 32, 43a; not *Bairdia simuvillosa*: McKenzie and Swain, 1967:283, pl. 30, fig. 1.

Bairdia sp. aff. *B. verdesensis*: Benson, 1959:42, pl. 1, fig. 6; pl. 8, fig. 16.

Diagnosis. — Elongate *Bairdia*, posteriorly tapered in side view, with straight venter; greatest height in anterior third, greatest width just anterior to midlength; posterodorsum slightly concave up due to brief hump on caudal process.

Description. — In side view: anteroventer evenly rounded; venter straight or slightly concave; posteroventer gently rounded to pointed posterior; posterodorsum slightly convex anterior to brief hump on caudal process; dorsum and anterodorsum almost straight, divided by a rounded anterocardinal angle. Left valve overlapping right valve along all margins except at extreme posterior ventral part of pointed caudal process. In dorsal view: carapace roughly diamond-shaped; greatest width just anterior midlength. Surface of valves smooth, marginal denticles absent, even in younger individuals.

Duplicature moderately wide; anterior and posterior vestibules large. Fused part of duplicature transected by abundant simple radial pore canals, about 50 anteriorly, fewer posteriorly. Normal pores abundant, small, relatively few in center of carapace.

Adductor muscle scars tending to fuse, pattern of an elongate scar above two larger irregular scars which in turn top two smaller oval scars. Dimorphism not observed.

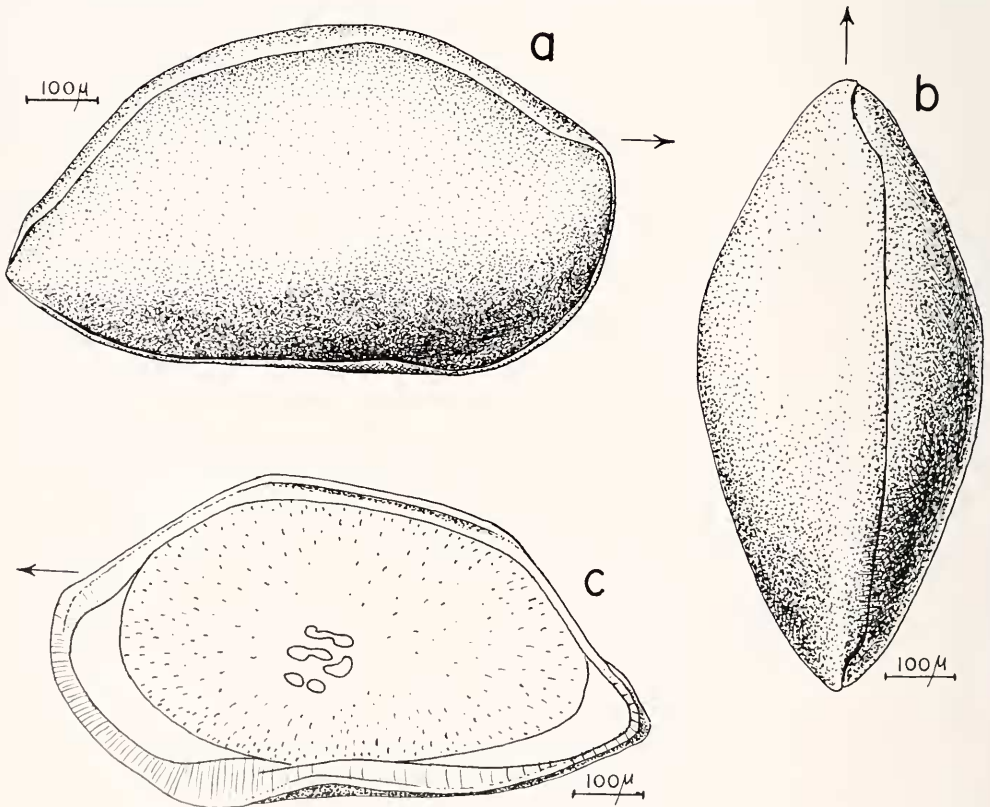


Figure 3. *Bairdia simuvillosa* Swain, 1967. a-b, hypotype, USNM 128066; a, right valve view of adult carapace; b, dorsal view of adult carapace. c, hypotype, USNM 128067; interior of adult right valve.

Dimensions.

	Length	Height	Width
Hypotype, USNM 128066. Adult carapace, sta. B-4244, 47	866	510	396
Hypotype, USNM 128067. Adult right valve, sta. B-4244, 47	850	465	187
Hypotype, SDNH 04189. Adult carapace, sta. B-4244, 47	787	449	346
Hypotype, SDNH 04190. Adult carapace, sta. B-4244, 47	800	443	345
Hypotype, SDNH 04191. Adult carapace, sta. B-4244, 47	801	463	362

Discussion.— Seven specimens were found only at station B-4244-47 in the brackish-freshwater lagoon and are apparently relics from a past marine condition.

This species is identical to a species found in the Gulf of California and on the Pacific side of the peninsula at Todos Santos Bay. Another form from Scammon Lagoon (McKenzie and Swain, 1967) is not considered conspecific because it has a more rounded dorsum and posterior, and relatively fewer normal pores

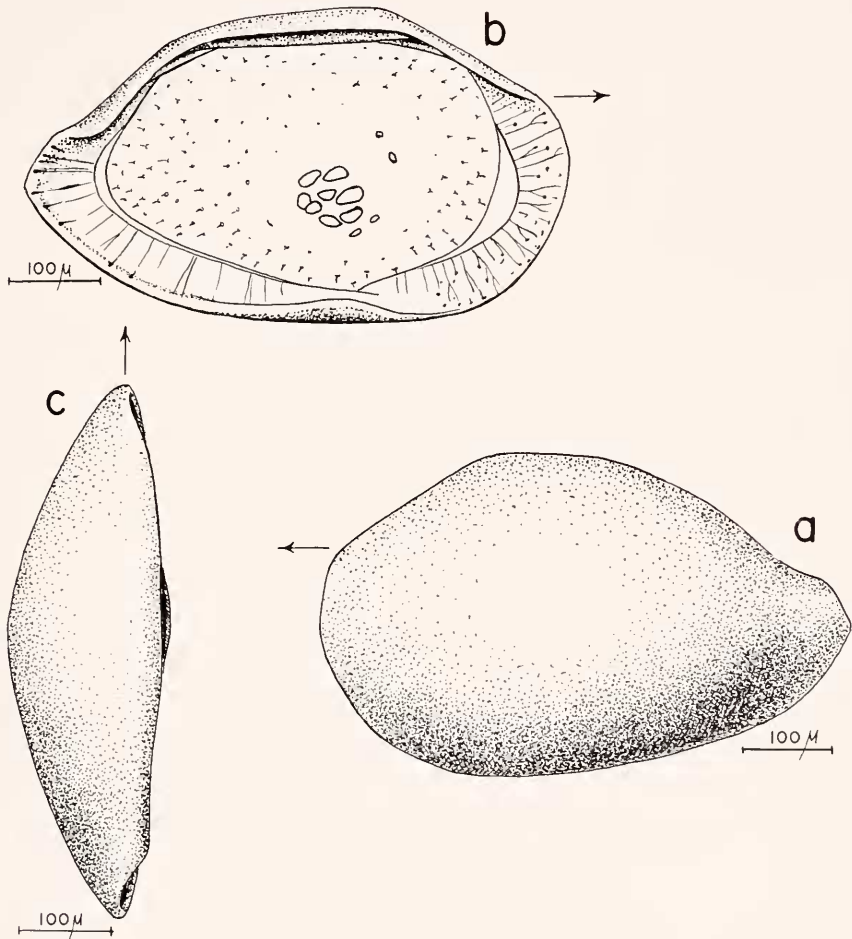


Figure 4. *Bairdia ritugerdia clippertonensis* subsp. nov. a-c, holotype, SDNH 04192: a, lateral view of adult left valve; b, interior view of adult left valve; c, dorsal view of adult left valve.

***Bairdia ritugerdia clippertonensis* subsp. nov.**

Figure 4

Diagnosis.— Centrally inflated *Bairdia* with greatest height at anterocardinal angle in anterior third; caudal process humped, slightly pointed at posterior-most part; duplicatures vestibulate; young with posteroventral marginal serrations. Subspecies *B. r. clippertonensis* is smaller (600-750 μ) than *B. ritugerdia* sensu stricto; less acuminate posteriorly.

Description.— Carapace small for genus, adult length 600-750 μ ; surface of valves smooth to inconspicuously pitted by large but shallow depressions. In side view: left valve much higher than right valve along dorsum and at inturned area; dorsal margin broadly arched, flattened in anterior third, sometimes flattened at midlength, slightly concave in posterior above humped caudal process; greatest carapace height in anterior third of length; anteroventral margin smooth in adults, serate in young. In dorsal view: carapace inflated at midlength or just anterior to midlength; posterior and anterior extremities pointed.

Duplicature wide, heavy; narrow vestibules present; straight or bifurcating radial pore canals numerous, up to 50 anteriorly, most false; normal pores small, numerous except around adductor muscle scar area. Eight adductor muscle scars in tight cluster near center of valve.

Dimensions.—

	<i>Length</i>	<i>Height</i>	<i>Width</i>
Holotype, SDNH 04192. Adult left valve, sta. B-6101	595	413	176
Paratype, USNM 128089. Adult left valve, sta. B-6120	759	449	196
Paratype, USNM 128090. Adult right valve, sta. B-6120	755	413	150
Paratype, USNM 128091. Adult right valve, sta. B-6120	680	370	137

Discussion.— The species is much smaller at Clipperton Island than that at Hawaii, where it reaches lengths of 1000 μ and more (Holden 1967: 13). The size difference, together with differences in shape of the carapace distinguish the two populations as separate subspecies.

Its habitat preference is unknown as no living individuals were found. Ten specimens were found off the submerged terrace at 40-45 m, whereas only two specimens were found in shallower water, perhaps indicating a preference for moderately deep water.

***Bairdia teeteri* sp. nov.**

Figures 5, 6

Diagnosis.— *Bairdia* with upturned pointed caudal process; valves heavily pitted; antero and posterolateral surfaces with horizontal ridges giving carapace a terminally blunt aspect as seen from above.

Description.— In side view: venter straight to slightly concave downward, anteroventer and posteroventer about equal in length and convexity; posterodorsum and anterodorsum about equal in length and inclination from horizontal, each slightly concave up; dorsum straight to slightly rounded. Left valve strongly over-reaching and over-lapping right valve in dorsal region, with low keel along highest points of dorsum; horizontal anterolateral ridge developed at midheight; horizontal posterolateral ridge extending along pointed, upturned caudal process. Possible sexual dimorphism expressed by relatively lower form (σ ?) with height/length ratio = 0.54 compared to (φ ?) 0.60.

In dorsal views: anteromost and posteromost parts of horizontal lateral marginal ridges sometimes knob-like giving carapace terminally blunt appearance; centrolateral region inflated, compressed near margins; width/length ratio about 0.40; surfaces densely pitted.

Hinge of "*Bairdiopillata*"-type with small toothlets near posterodorsal and anterodorsal extremities in right valve and corresponding tiny sockets in left valve. Duplicature wide, heavy, traversed by sparse simple radial pore canals numbering about 15 anteriorly and posteriorly, tending to occur in pairs. Vestibules shallow. Adductor muscle scar pattern with eight equant scars — a center scar with seven surrounding it; three smaller mandibular scars just anteroventral to adductor group.

Dimensions.—

	Length	Height	Width
Holotype, USNM 128093. Adult carapace, sta. B-6120	800	483	333
Paratype, SDNH 04193. Adult left valve, sta. B-6101	750	435	190
Paratype, SDNH 04193. Adult right valve, sta. B-6101	749	388	117
Paratype, SDNH 04194. Adult carapace, sta. B-6120	792	461	313
Paratype, SDNH 04195. Adult left valve, sta. B-6101	695	404	165
Paratype, USNM 128092. Penultimate carapace, sta. B-6120	659	367	253
Paratype, SDNH 04196. Penultimate carapace, sta. B-6120	612	345	229

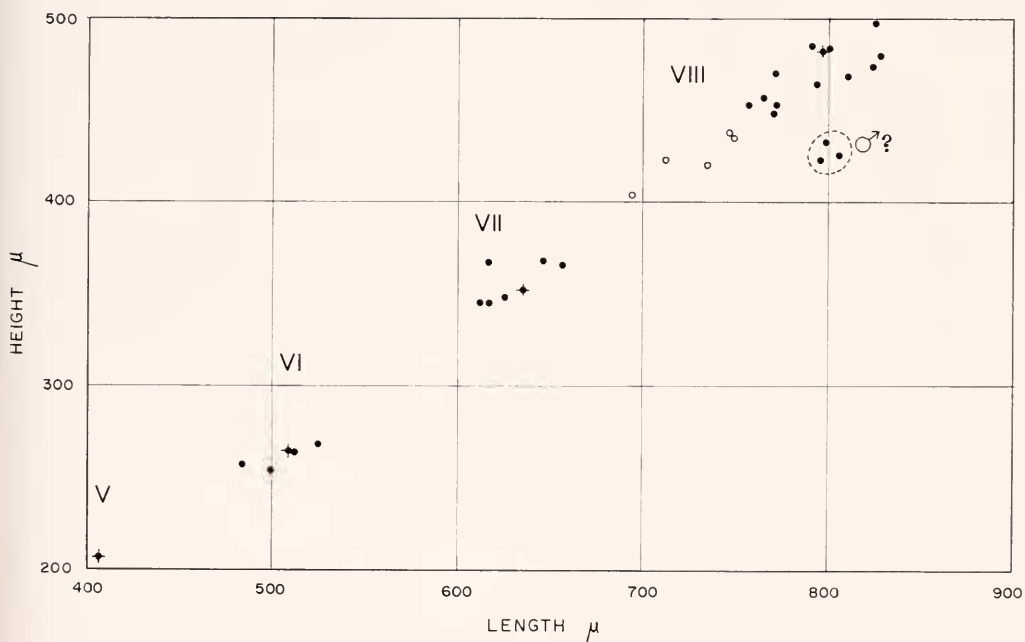


Figure 5. Length-height plot of five growth stages of *Bairdia teeteri* sp. nov. from stations B-6120 (o), B-6101 (o), and B-4241 (o). The group isolated by dashed lines are thought to be males showing higher length-height ratios (Kornicker, 1961). All measurements taken from entire carapaces or the larger left valves.

Discussion.— *Bairdia teeteri* is closely related to *B. attenuata* Brady, 1880, from the Indopacific and possibly from off the coast of west Africa (Egger, 1901) in general shape, ornamentation, adductor muscle scar pattern and duplicature. Holden (1967: 14) described the internal features of *B. attenuata* to which the present species can be compared. The important difference between the two species is the presence of horizontal ridges on the antero and posterolateral surfaces of *B. teeteri* which are lacking on *B. attenuata*. The species might be confused with *B. bradyi* Bold, 1957, which has similar ornamentation and somewhat the same shape in side view, but is much wider and diamond shaped in dorsal

view, not laterally compressed as *B. teeteri*. Another species belonging to the *B. attenuata* group and closely related to the present species is *Bairdia* sp. *c* of Bold (1966) from Coco Solo, Panama. It appears to have a poorly developed horizontal ridge on the posterolateral surface. According to Bold (personal comm.) the species occurs on the Pacific side of Costa Rica in rocks of "Young Neogene" age.

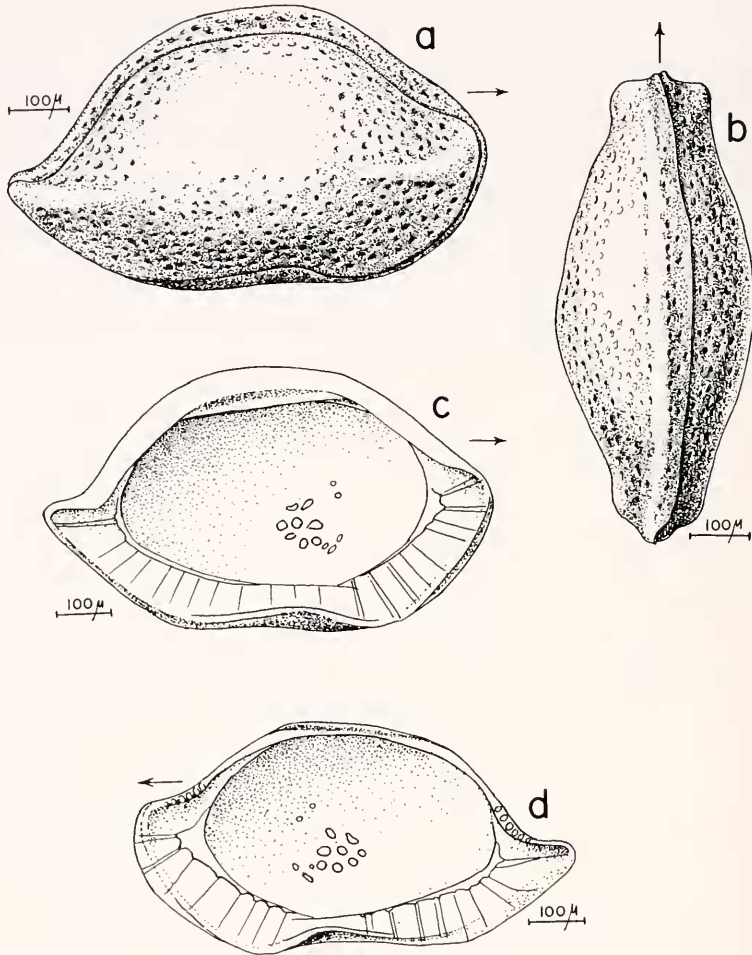


Figure 6. *Bairdia teeteri* sp. nov. a-b, holotype, USNM 128093; a, right valve view of adult carapace; b, dorsal view of entire carapace. c-d, paratype, SDNH 04193; c, interior view of adult left valve, d, interior view of adult right valve.

At Clipperton Island sizes of individuals differ consistently between the stations B-6120 and B-6101 (see text-fig. 5). The adductor muscle scar pattern and the "*Bairdiopilata*"-type dentition seem to be consistent as are other features and size differences apparently are not taxonomically significant.

The species is named for James Wallis Teeter, who in 1966 recognized its uniqueness during a study of British Honduras ostracodes.

Bairdia sp. indet.

Figure 7

Description.— In dorsal view: carapace elongate, cylindrical, densely pitted, dark amber colored; dorsal margin arched, parallel with arched ventral margin; posterodorsal margin straight, angled $\sim 45^\circ$ from horizontal; anterior margin bluntly rounded beneath sharply angled anterocardinal angle. In dorsal view: carapace width about equal height along mid 4/5 of length; terminally blunt; anterior and posterior valve junctures with small lip-like ridge.

Anterior duplicature wide with large vestibule; posterior vestibule moderately wide with outer marginal half fused. Radial pore canals simple, straight, many occupying marginal denticles, alternating with interspaced false radial pore canals. Normal pores small, open type, interconnecting internal pit to external. Muscle scars not observed.

Dimensions.—

	Length	Height	Width
Specimen, SDNH 04197. Adult right valve, sta. B-6120	664	289	136
Specimen, USNM 128068. Penultimate? Left valve, sta. B-6120	471	232	99

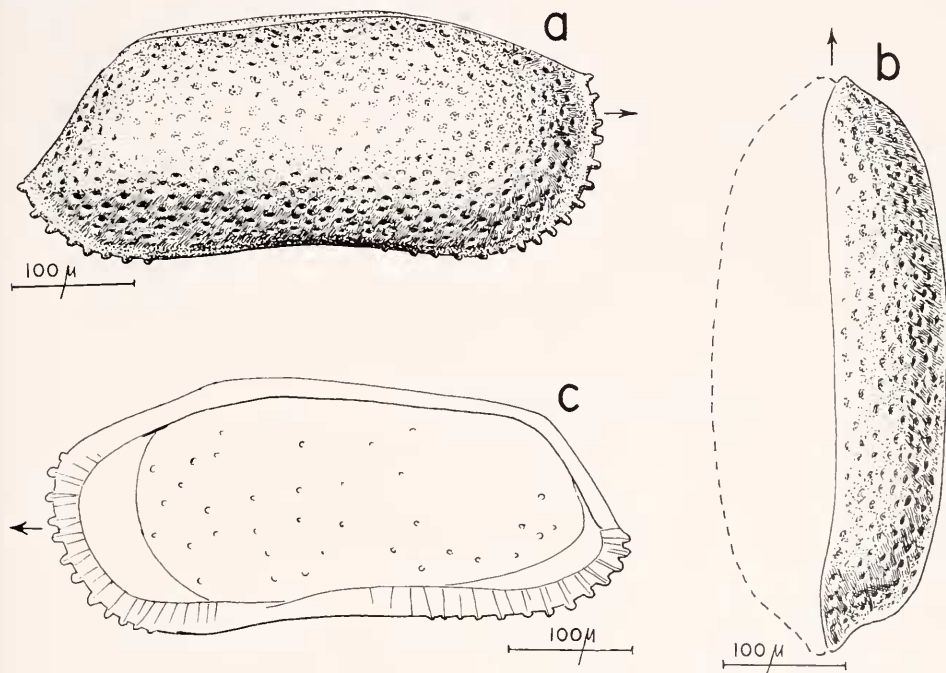


Figure 7. *Bairdia* sp. a-c, specimen, SDNH 04197; a, lateral view of adult right valve; b, dorsal view of adult right valve; c, interior view of adult right valve.

Discussion.— Only two specimens, of which one was an adult, were found at station B-6120. The good condition of the adult carapace, including original coloration, suggests that the species is living close by, perhaps in shallower water. The inflated cylindrical carapace is indicative of a group of bairdiids including *Bairdia acanthigera* Brady from Cape Verde at 1020–1150 fms, *B. tuberculata* Brady from the Admiralty Islands at 16–25 fms, and *B. hanaumaensis* Holden from the Hawaiian Islands at about 5 fms. The general shape alone of these species would seemingly justify their assignment to a new genus.

The species is closely related and possibly conspecific with a Caribbean species listed as *Bairdia* cf. *B. tuberculata* by Puri (1960), but differs primarily by being more elongate and having a higher anterior margin as viewed from the side.

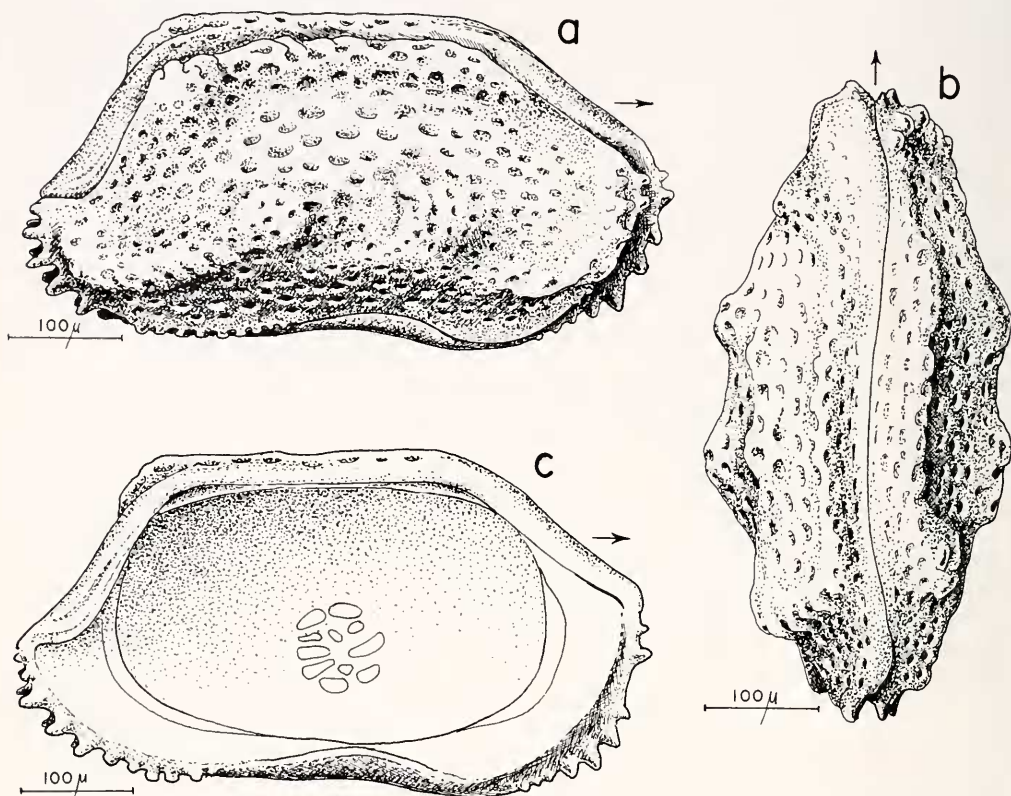


Figure 8. *Triebelina sertata* Triebel, 1948. a-c, hypotype, USNM 128069; a, right valve view of adult carapace; b, dorsal view of adult carapace; c, interior view of adult right valve.

Genus *Triebelina* Bold, 1946

Triebelina sertata Triebel, 1948

Figure 8

Triebelina indopacifica van den Bold, 1946: 74, fig. 7 in part.

Triebelina sertata Triebel, 1948: 29, pl. 19, figs. 1a-b, 2a-d; Key, 1953: 158, pl. 1, fig. 5; Puri, 1960: 132, figs. 3, 4;

Guha, 1968: 59, pl. 5, fig. 1.

Triebelina sp. cf. *T. cubensis* Kingma, 1948: 69, pl. 7, fig. 4.

Diagnosis. — Carapace robust, pitted, widest at two large swellings on each valve along midlength; strong dorsal ridge curving downward in posterior part of left valve, confined to dorsum in right valve.

Description. — See Triebel (1948) for a complete description of the species.

Dimensions. —

	Length	Height	Width
Hypotype, USNM 128069. Adult left valve, sta. B-6120	572	310	170
Hypotype, USNM 128069. Adult right valve, sta. B-6120	570	283	146

Hypotype, SDNH 04199. Penultimate left valve, sta. B-6120	484	244	142
Hypotype, SDNH 04200. 6th instar, left valve, sta. B-6120	409	213	125

Discussion — *Triebelina sertata* and *T. indopacifica* are closely related (Triebel, 1948). The most conspicuous differences between the two are the lack of swellings in the dorsolateral areas of both valves and the reduction of the long ventrolateral ridge into two broad nodes on each valve along the midlength in *T. sertata*.

According to Key (1953), Bold (1946) had a specimen of what was described as *Triebelina sertata* in his collection of *T. indopacifica* from Ceram, West Indies. Key also noted that the single valve of Kingma's (1948) *Triebelina* cf. *T. cubensis*, from the lower Pliocene of Sumatra, is conspecific to *T. sertata*. One notices that the computed length-height ratio from Kingma's data agrees well with those of other specimens of *T. sertata* but does not agree with his illustrations, which must be distorted.

The species appears to be a shallow water inhabitant. At Clipperton Island it is found from six to 45 meters (none living). One of us (Holden) collected it along beaches at Vanuambalavu, Fiji; Puri found it on reefs in the Florida Keys; and, Triebel reported it from shallow water in the Red Sea. Key's material consisted of one valve each at five stations in the East Indies ranging in depth from 372 to 3221 meters probably representing redeposition.

Triebelina rugosa sp. nov.

Figure 9

Triebelina bradyi: Puri, 1960:132, pl. 6, figs. 7-8.

Diagnosis. — Carapace small, length less than 500 μ , relatively elongate, L/H ratio about 2.0, valves nearly equal in height; carapace compressed with parallel sides; lateral surfaces with small prominent tubercles in posterior and anterior lateral areas, two distinct tubercles one above the other beneath posterior cardinal angle.

Description. — In side view: carapace elongate, L/H ratio about 2.0; dorsal margin straight, subparallel with slightly concave downward ventral margin; posterodorsal margin deeply concave upward above serrate caudal process terminating at midheight; anterior margin denticulate beneath flattened anterodorsal margin. Valves unequally ornamented: left valve with more strongly developed short tuberculate vertical posterior ridge than right valve; right valve with two narrow horizontal, sometimes discontinuous, ridges interconnecting anterior lateral tubercles with posterior vertical ridge; both valves tuberculate in anterolateral areas. In dorsal view: carapace compressed, L/W ratio about 2.8; sides flattened, parallel; caudal region compressed behind vertical posterior ridges of right and left valves.

Duplicature wide, heavy, shallow vestibules present with straight, thin radial pore canals. Eight elongate, inclined adductor scars near midheight of valve interior.

<i>Dimensions</i> . —	Length	Height	Width
Holotype, USNM 128094. Adult left valve, sta. B-6120	478	237	167
Holotype, USNM 128094. Adult right valve, sta. B-6120	477	221	167
Paratype, SDNH 04198. Adult carapace, sta. B-6120	466	224	158

Discussion. — The specimens from Clipperton Island are conspecific with a species identified incorrectly as *Triebelina bradyi* by Puri (1960) from the west coast of Florida, and also known to occur in shallow waters of the British Honduran carbonate shelf (Teeter, 1966). This Caribbean-Clipperton species is clearly distinct from the Indopacific *T. bradyi* which is larger (more than 500 μ), higher and has a few broad swellings for

ornamentation. *Triebelina bradyi*, in addition, lacks the heavily denticulate, broadly, evenly rounded posteroventral margin of *T. rugosa*.

Triebelina rugosa may have a remote ancestor in *Triebelina* sp/498 of Kollmann (1963) of Triassic (Rhaetic) age from the European Alps. They are strikingly similar in outline and both have ubiquitous elongate pits for ornamentation. They differ in tubercle and swelling arrangement on the lateral surfaces and size of carapace with *T. rugosa* being less than half the size of *T. sp/498*.

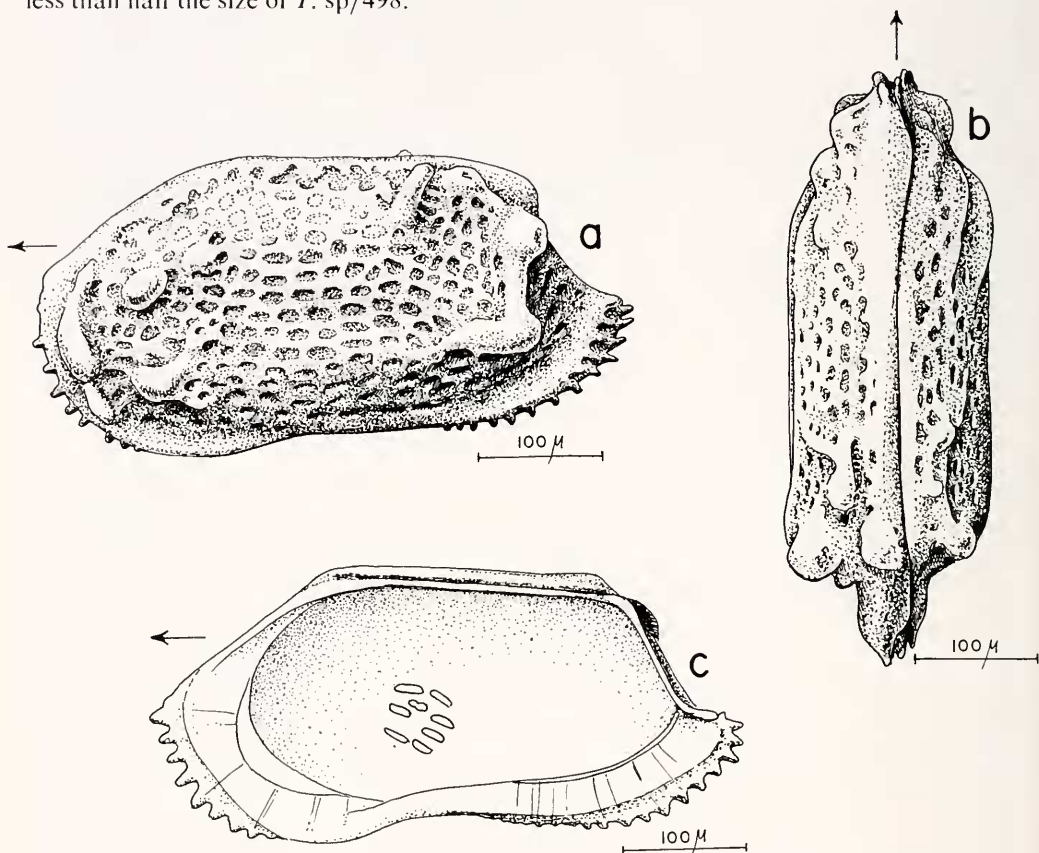


Figure 9. *Triebelina rugosa* sp. nov. a-c, holotype, USNM 128094; a, left valve view of adult carapace; b, dorsal view; c, internal view.

Puri did not give the depth distribution of the species in the Caribbean; however, we presume it is a shallow water form. In the Caribbean it is found at Molasses Reef, off Tavernier, in the Florida Keys (Puri, 1960). At Clipperton Island the species occurs no shallower than 40 meters at station B-6120 on the rubble slope beneath the principal submarine terrace of the island. One valve was found at 92 m at station B-8558.

Superfamily Cypridacea Baird, 1849
 Family Cyprididae Baird, 1849
 Subfamily Macrocypridinae Müller, 1912

Genus *Macrocyprina* Triebel, 1960***Macrocyprina vargata* sp. nov.**

Figures 10, 11

Diagnosis. — Carapace strongly arched, angled at highest point at mid-dorsum; posterior bluntly pointed; light brown color pattern in live specimens distinctive with broad somewhat inclined bands extending halfway down shell from cardinal angles, large circular light brown spot surrounding muscle scar area, and at dorsum.

Description. — Carapace heavy, large, length 900-940 μ , light brown color pattern in live specimens consisting of two somewhat oblique broad bands extending half way down carapace from cardinal angles, large circular spot at center of shell corresponding with adductor muscle scar pattern, large spot at mid-dorsum of carapace tending to elongate and merge with central color spot. In side view: carapace reinform, dorsum highly arched, somewhat angled at midlength; ventral margin broadly concave downward; anterior margin evenly rounded, posterior margin bluntly pointed; right valve overlapping left valve in anterodorsum, posterodorsum, along venter. In dorsal view: carapace bluntly pointed at posterior and anterior; greatest width at midlength. Both sexes present; sexual dimorphism not evident in carapace.

Duplicatures wide, with irregular vestibules intruding into fused zone sometimes as little pockets from which one or two true or false radial pores extend; radial pore canals sparse for genus, some paired. Normal pores small, sieve type, about 40-50 in ventral half, sparse in dorsal half. Hinge of right valve of finely crenulate bar terminating posteriorly and anteriorly with small crenulate projecting cusps grading into terminal crenulate grooves about 110 μ in length. Ten adductor muscle scars located beneath midheight and just anterior to midlength; two mandibular scars located anteroventral to adductor group.

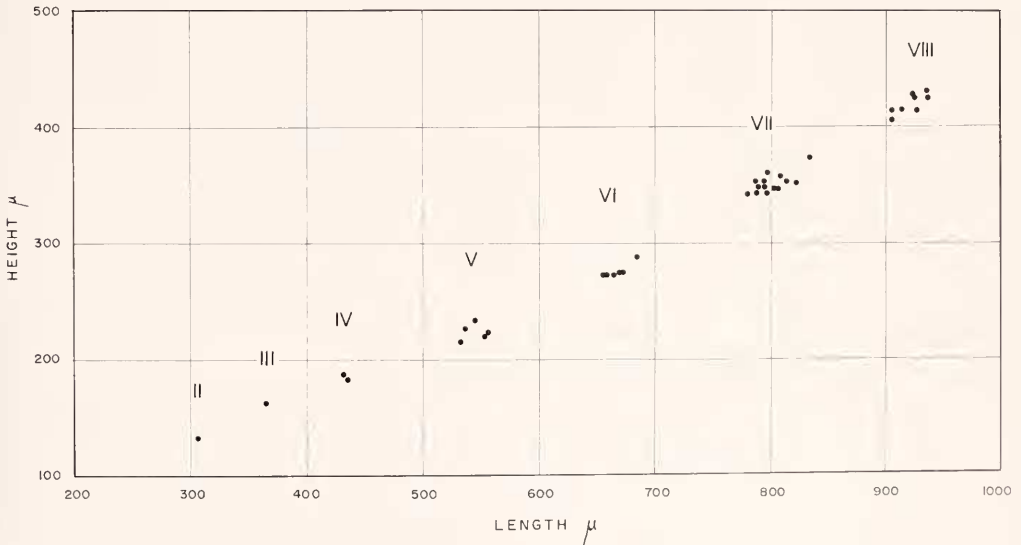


Figure 10. Length-height plot of seven growth stages of *Macrocyprina vargata* sp. nov. from stations B-6120 and B-6101.

Dimensions. —

	Length	Height	Width
Holotype, USNM 128095. Adult carapace, sta. B-6101	926	410	307
Paratype, USNM 128096. Adult right valve, sta. B-6101	919	420	316
Paratype, USNM 128096. Adult left valve, sta. B-6101	925	422	316
Paratype, SDNH 04201. Penultimate carapace, sta. B-6120	798	360	254
Paratype, USNM 128097. Penultimate carapace, sta. B-6120	821	354	260
Paratype, SDNH 04202. Adult carapace, sta. B-6120	937	430	314
Paratype, USNM 128098. 6th instar carapace, sta. B-6120	550	225	179
Paratype, SDNH 04203. 6th instar carapace, sta. B-6120	538	229	194

Discussion. — The type species of the genus, *Macrocyprina propinqua* Triebel (1960) has a more evenly rounded dorsum, is more terminally pointed in dorsal view, and is slightly larger (950-1008 μ) than the Clipperton species. The color pattern is similar, though of

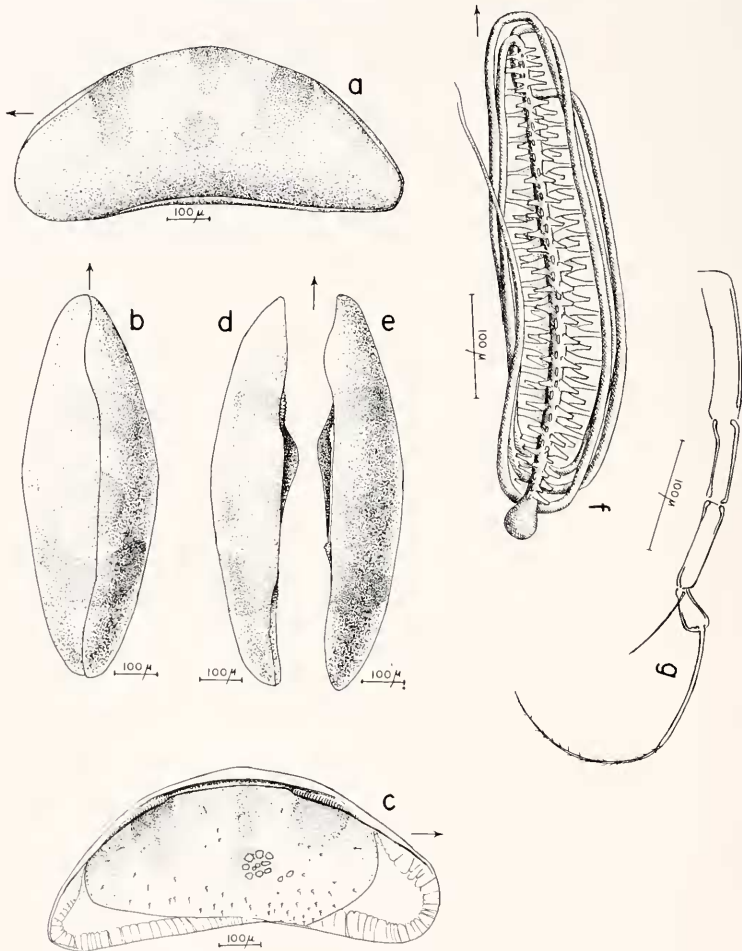


Figure 11. *Macrocyprina vargata* sp. nov. a-b, holotype, USNM 128095; a, lateral left valve view of adult carapace; b, dorsal view of adult carapace; c-e, paratype, USNM 128096; c, interior view of adult left valve; d, dorsal view of adult left valve; e, dorsal view of adult right valve; f, ejaculatory duct, f, third thoracic leg.

greater relative size, and does not tend to form bands but rather spots in *M. propinqua*.

Macrocyprina vargata is also like the southern hemisphere species *M. decora* (Brady, 1866) in general shape though more terminally blunt, as seen from above, and smaller with adult lengths ranging from 900-940 μ as opposed to 1005-1010 μ as cited by Brady (1866, 1880). In addition, the color markings between the two species differ considerably (compare with Brady, 1880, pl. 6, figs. 8a-b).

The species also resembles *Macrocypris succinea* Müller, 1894, from the Gulf of Naples in general shape but, again, is more bluntly pointed in dorsal view. In these two species the central muscle scar patterns are comparable each with the same number of scars in approximately the same relative positions. The two small frontal scars shown on Müller's pl. 13, fig. 25 do not appear on *M. vargata*, however. The male ejaculatory apparatus (Zenker's organ) in the two species has the same characteristics, i.e., a central spiny shaft terminating posteriorly in a smooth bulb-like structure and the same complexly twisted tubing. In *M. vargata*, however, the posterior bulb-like structure is much smaller and the central shaft and tubing are much narrower. Also, the central shaft possesses more and longer spines. Zenker's organ of *M. propinqua* and *M. vargata* appear very similar.

The specific name denotes the broad vertical color stripes shown in living individuals, *vargatus* (L.), "striped."

Subfamily Cypridopsinae Kaufmann, 1900

Genus *Potamocypris* Brady, 1870

***Potamocypris insularis* sp. nov.**

Figure 12

Diagnosis. — Smooth, highly unequivalved species of *Potamocypris* with posterior flange of left valve overreaching right valve. As seen from above, anterior terminating in sharp point canted slightly to the left.

Description. — In side view: carapace high, length/height ratio about 1.6; length of adult 600-700 μ ; outline subtriangular, highest point just anterior to midlength at highly angled dorsum; ventral margin straight to slightly concave; posterior margin of right valve steeply truncate; bluntly pointed near venter in left valve; right valve larger than left valve, overreaching left valve along dorsum where it is considerably higher and along venter and anterior; left valve overreaching right valve posteriorly as a caudal flange. In dorsal view: length/width ratio from 2.5 to 2.9; outline irregularly lenticular; greatest width near midlength, anterior sharply pointed, posterior bluntly pointed.

Calcified duplicature poorly developed, present only in left valve anterior. Radial pore canals short, simple. Normal pores numerous, small, open type. Hinge adont. Adductor muscle scar pattern composed of five scars, top scar elongate, second and third an oblong pair, fourth scar elongate, fifth scar small, circular.

Dimensions. —

	Length	Height	Width
USNM, Holotype 128099. Adult carapace, sta. B-4244, 47	692	416	250
USNM, Paratype 128100. Adult right valve, sta. B-4244, 47	612	333	113
SDNH, Paratype 04204. Adult carapace, sta. B-4244, 47	701	412	258
SDNH, Paratype 04205. Adult carapace, sta. B-4244, 47	677	392	234

Discussion. — *Potamocypris insularis* has only five scars in the adductor pattern, unlike most species of the genus which have six or seven. There is an apparent reduction occurring in the ventral part of the pattern.

The closest living *Potamocypris* to Clipperton Island is *P. islagrandensis* which occurs

in Lake Nicaragua, Central America. *Potamocypris insularis* is relatively higher, has a pointed posterior and has a different adductor muscle scar pattern than *P. islagrandensis* (Swain and Gilby, 1964).

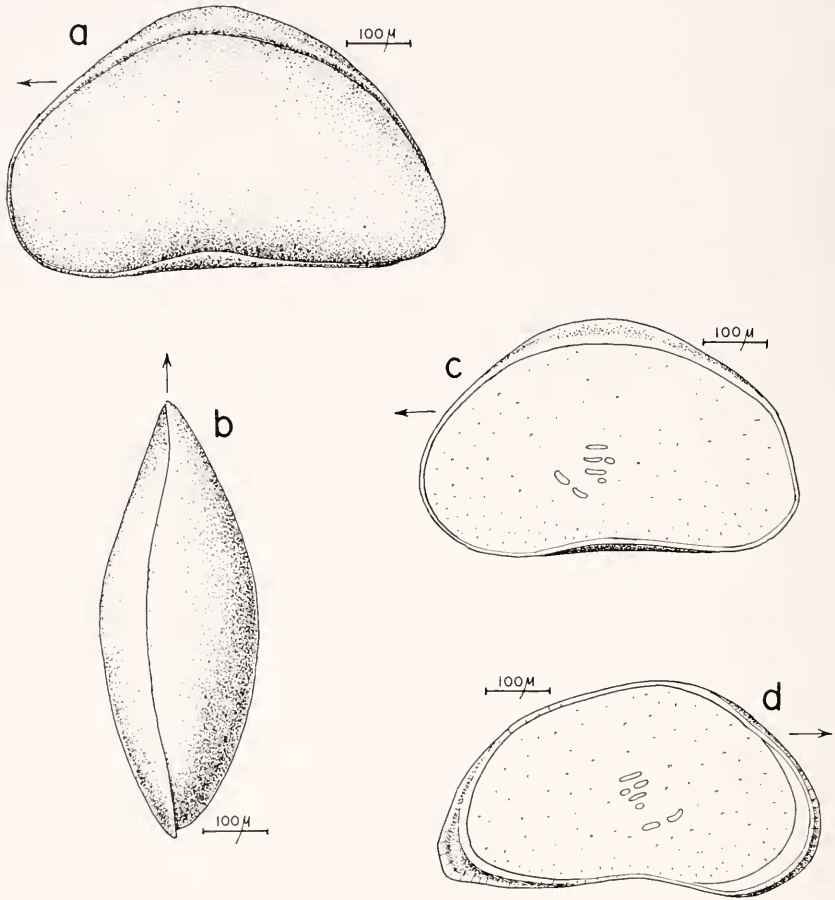


Figure 12. *Potamocypris insularis* sp. nov. a-b, holotype, USNM 128099; a, lateral left valve view of adult carapace; b, dorsal view of adult carapace. c-d, paratype, USNM 128100; c, interior view of adult right valve; d, interior view of adult left valve.

Genus *Cyridopsis* Brady, 1868

***Cyridopsis oceanus* sp. nov.**

Figure 13

Diagnosis. — Carapace small, 580 μ in length; smooth; moderately inflated (length/width = 1.60); greatest height and width near midlength.

Description. — Carapace thin, transparent, smooth; living specimens covered with sparse short hairs; width slightly greater than height, length 1.60 times width. In side view: dorsal margin sloping off straight posteriorly and anteriorly from angled high point at carapace midlength; posterior and anterior margins similarly shaped, broadly rounded; ventral margin straight to slightly concave; valves somewhat unequal, left valve slightly over-

reaching right valve anteriorly, being barely overreached by right valve posteriorly; left valve strongly overlapping right valve at ventral inturred area. In dorsal view: carapace ovalenticular, greatest width behind midlength, width slightly greater than height.

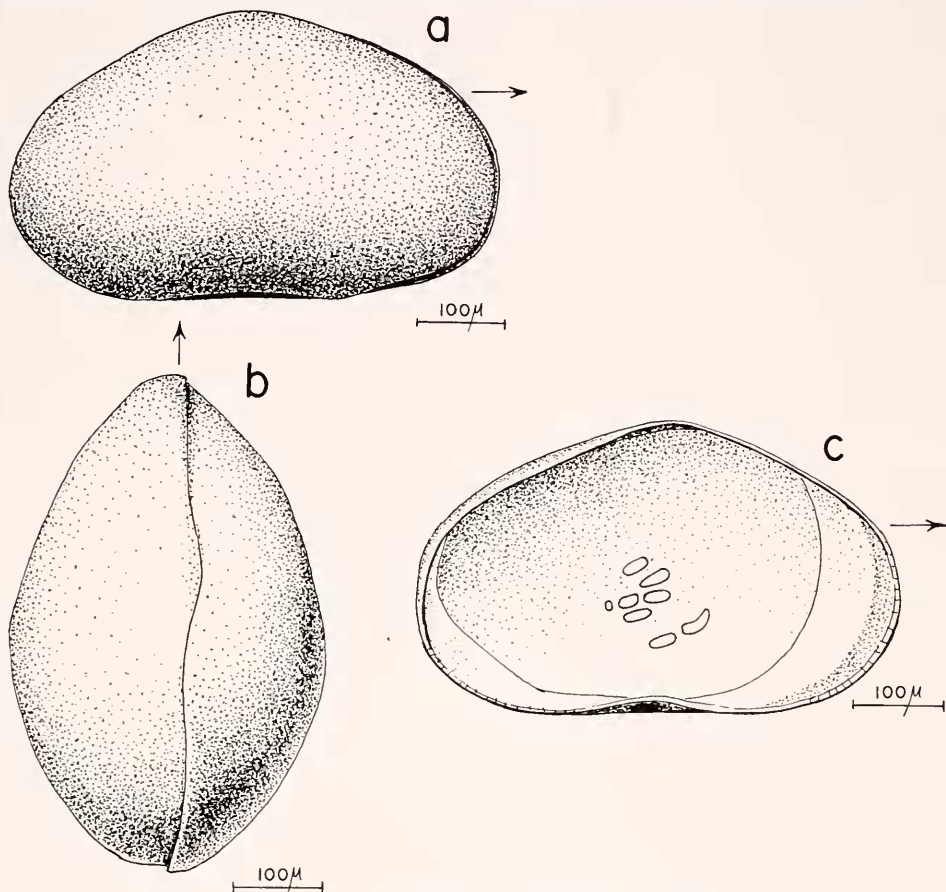


Figure 13. *Cypridopsis oceanus* sp. nov. a-b, holotype, USNM 128101; a, lateral view of adult right valve; b, dorsal view of adult right valve. c, paratype, USNM 128102; interior view of adult left valve.

Anterior duplicature wide, fused zone narrow with many small simple radial pore canals; posterior duplicature half as wide as anterior. Adductor pattern of five equant scars in central field with sixth small scar in posteroventral part of field; antennal scars large, oblong, beneath and in front of adductor muscle scar pattern. Normal pores minute, sparse, evenly distributed.

Dimensions.—

	Length	Height	Width
Holotype, USNM 128101. Adult carapace, sta. B-4244, 47	579	328	355
Paratype, USNM 128102. Adult left valve, sta. B-4244, 47	544	319	326
Paratype, USNM 128102. Adult right valve, sta. B-4244, 47	545	316	325
Paratype, SDNH 04206. Adult carapace, sta. B-4244, 47	562	354	356
Paratype, SDNH 04207. Adult carapace, sta. B-4244, 47	587	344	366
Paratype, SDNH 04208. Adult carapace, sta. B-4244, 47	548	325	350
Paratype, SDNH 04209. Adult carapace, sta. B-4244, 47	563	339	359

Discussion.— This species bears some resemblance to *Cypridopsis vidua* (O. F. Müller, 1776) but is much smaller, unpitted, and has a blunter posterior viewed from the side. Also, there are six adductor scars as in *C. vidua* but their relative positions differ (compare with Morkhoven, 1963, p. 48). The size of *Cypridopsis oceanus* is consistently less than 600 microns compared with 700 microns for *C. vidua* (Wagner, 1957).

The actual salinity range of the lagoon when the species was collected is not known; however, it was palatable. Allison noted when diving in the lagoon that the salinity increased with depth. Breakers will occasionally reach the lagoon during storms. Considering these factors, *Cypridopsis oceanus* probably has a much higher salinity tolerance than *C. vidua* which apparently cannot survive marine salinities greater than 0.8% (Wagner, 1957:110; Reyment, 1964:75).

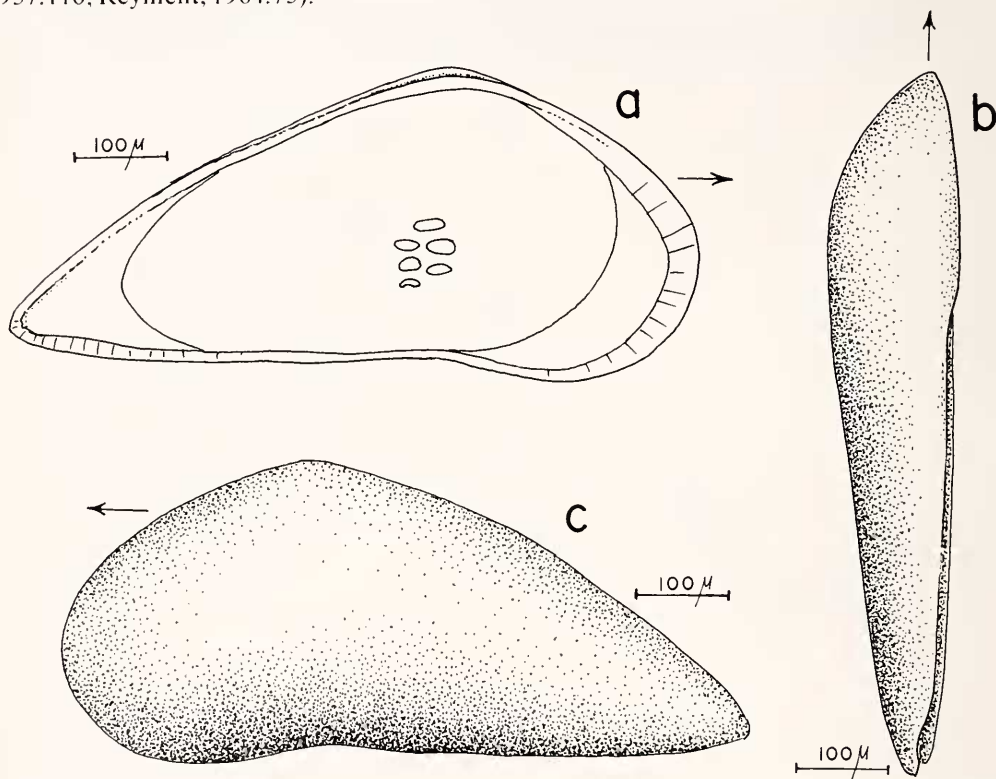


Figure 14. *Pontocypris?* sp. a-c, specimen, USNM 128070; a, interior view of adult left valve; b, dorsal view of adult left valve; c, lateral view of adult left valve.

Subfamily Pontocypridinae Müller, 1894

Genus *Pontocypris* Sars, 1866

Pontocypris? sp.

Figure 14

Description.— Carapace acuminate posteriorly, terminating in a sharply pointed posterior in both dorsal and side views. In side view: greatest height at sharply angled point in anterior third; anterodorsum and posterodorsum sloping away from the highest point at angles of about 30° from the horizontal; posterodorsal margin almost straight, terminating

in pointed ventral posterium; ventral margin straight except for slight convexity at inturned area. In dorsal view: carapace compressed, greatest width in anterior quarter, right valve overlapping left valve posterior to greatest carapace height in anterior third.

Duplicature wide in both posterior and anterior parts of valve. Fused zones narrow, containing several straight, simple radial pore canals. About six oblong adductor scars located in region above inturned area.

Dimensions. —

	<i>Length</i>	<i>Height</i>	<i>Width</i>
Specimen USNM 128070. Adult left valve, sta. B-6101	740	347	140
Specimen SDNH 04210. Adult carapace, sta. B-6120	742	342	228
Specimen SDNH 04211. Adult left valve, sta. B-6120	726	317	119
Specimen USNM 128071. 6th instar carapace, sta. B-6120	512	227	158
Specimen SDNH 04212. 6th instar right valve, sta. B-6120	524	212	90
Specimen SDNH 04213. 5th instar carapace, sta. B-6120	411	170	142
Specimen USNM 128072. 4th instar carapace, sta. B-6120	325	134	117

Discussion. — The carapace, as seen in side view, has the triangular shape of *Pontocypris* but the muscle scar pattern suggests the genus *Propontocypris*. The two genera originally were established on the basis of soft parts not preserved in the Clipperton collection.

Pontocypris? sp. is best compared to *P. accuminata* Müller, 1894, from the Gulf of Naples. The Clipperton species has, however, a straighter dorsal margin in the posterior two thirds, is more posteriorly acuminate and internally it has a less extensive duplicature and lacks the typical *Pontocypris* muscle scar pattern.

Superfamily Cytheracea Baird, 1850

Family Bythocytheridae Sars, 1926

Genus *Pseudocythere* Sars, 1866

Pseudocythere caudata Sars, 1866

Figure 15

Pseudocythere caudata Sars, 1866:88; Brady, 1868:453, pl. 34, figs. 49-52; Brady, 1880:144, pl. 1, figs. 6a-d; Müller, 1894:285, pl. 16, figs. 5, 10, 30-36; Tressler, 1941:102, pl. 19, fig. 15; Wagner, 1957:35, pl. 12; Benson, 1964:13, pl. 1, fig. 8; text-fig. 7.

Pseudocythere 1A Maddocks, 1966:62, text fig. 46, no. 2.

Diagnosis. — Because there is little agreement on what the salient characteristics are that define this species, a diagnosis is not presented here.

Description. — Side view: dorsal margin almost straight from top of high truncate caudal process to anterodorsal cardinal angle; anterior margin broadly rounded; ventral margin concave downward at centrally located inturned area; posteroventral margin formed by broad compressed marginal flange. Valves ornamented by continuous, discontinuous, occasionally merging, narrow horizontal ridges everywhere except on most of caudal process and on posteroventral flange which are smooth. In dorsal view: valve evenly inflated along length excluding laterally compressed caudal process; width of carapace would measure one-half length in entire specimen.

Duplicatures broad with large vestibules occupying one-half of duplicature width. Radial pore canals straight, some with enlargements near line of conrescences, sparse, about 10 anteriorly, relatively abundant in ventral half, about eight posteriorly. Normal pores not observed. Hinge weakly developed with elongate bar and subjacent groove. Adductor muscle scar pattern of three horizontally elongate scars in vertical row, bottom scar possibly two fused scars. Oval frontal scar anterior to topmost adductor scar. Soft parts not preserved.

Dimensions.

Hypotype, USNM 128073. Adult right valve, sta. B-6120

Length *Height* *Width*

285 158 69

Discussion. — Benson (1964:14) pointed out the improbability that all the reports of *Pseudocythere caudata* are referable to one species. However, no serious attempt has been made to separate this geographically widespread group into species or even subspecies. The single specimen found at station B-6120 is identified as *P. caudata* because it falls within the range of variation of other known populations and insufficient material does not allow a more critical analysis of it here.

Further studies may show that more important differences occur between warm water and cold water forms, irrespective of depth of water, than between forms separated by great distances of longitude. This relationship is suggested by a close resemblance between the Clipperton Island specimen and another shallow water reef form from northern Madagascar (Maddocks, 1966). In side view, specimens from both areas lack the posteroventral spine, at least in the right valve, and are more quadrate, with almost parallel ventral and dorsal margins, than the subtriangular, spined forms reported from cold or deep water areas. Future taxonomists should pay particular attention to the number of

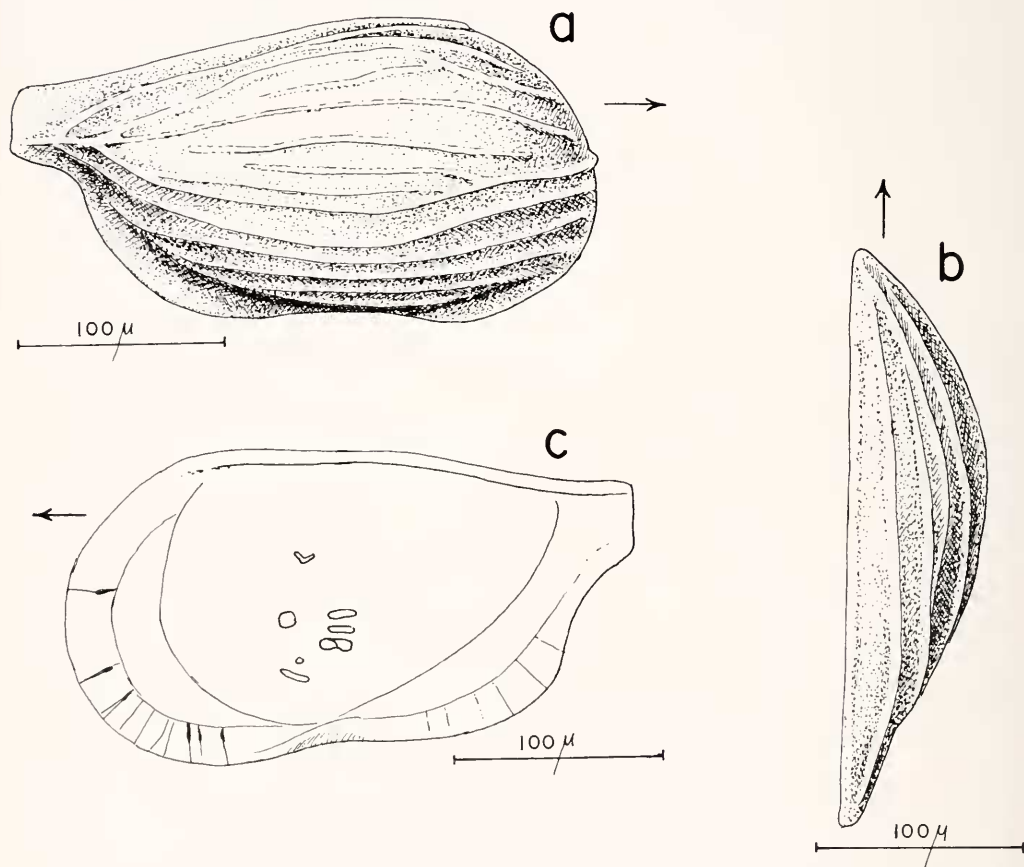


Figure 15. *Pseudocythere caudata* Sars, 1866. a-c, hypotype, USNM 128073; a, lateral view of adult right valve; b, dorsal view of adult right valve; c, interior view of adult right valve.

adductor muscle scars present. Some authors find five scars in the pattern, others only four. Possibly there is a reduction in the number of adductor scars in warmer water forms; indeed, the specimen from Clipperton Island approaches a condition of only three adductor scars with the bottom two scars almost fused (see Figure 15c). A form illustrated by Wagner (1957, pl. 12) from the Quaternary of the Pays Basin closely resembles the Clipperton Island and Madagascar forms in those features discussed above and also has only four adductor scars, but its ecology is unknown.

Pseudocythere caudata at Clipperton Island is considerably smaller than elsewhere, being only 285 microns long. The specimen is well developed internally and must be assumed to be an adult.

Family Cytheruridae G. W. Müller, 1894

Genus *Eucytherura* Müller, 1894

***Eucytherura binocula* sp. nov.**

Figure 16

Diagnosis. — Small *Eucytherura*, length 258-290 μ , very wide in posteroventer; surfaces entirely reticulate, with swellings, tubercles and spines developed to various degrees; eye tubercles and internal ocular sinuses large, distinct duplicature vestibulate.

Description. — Carapace small, size variable, length 258-290 μ , males somewhat smaller than females. In side view: dorsal margin generally straight, parallel with ventral margin; anterior margin flattened in dorsal half, strongly denticulate in rounded ventral half with four to five denticles and spines; caudal process blunt, near dorsum; posterior margin straight, obliquely angled at 45° beneath caudal process; surface of male valve usually with three large swellings; an interior subcentral swelling, posterodorsal swelling, and posteroventral swelling representing greatest width of shell, females without midswellings, more inflated; large smooth eye tubercle located just behind sharply angled anterocardinal angle in each valve; surfaces with deep reticulae, and variously developed, and variously spaced spines and tubercles. In dorsal view: carapace lanceolate (σ) to sublenticular (ρ), greatest width always in posterior half at posteroventral swelling; caudal process compressed and pointed; median sulcus poorly developed.

Posterior and anterior duplicatures of moderate width, each with small deep vestibulae tending to dip into the few, straight radial pore canals. Normal pores numerous, tending to occur in groups of up to three within the outlines of reticulae, usually accompanied by tiny conical projections deep within the reticulae, the number of conical projections approximates that of the pores. Hinge typical for genus: small entire terminal teeth of right valve separated by finely crenulate groove. Muscle scar pattern and soft parts not preserved.

Dimensions. —

	<i>Length</i>	<i>Height</i>	<i>Width</i>
Holotype, USNM 128103. Adult carapace, sta. B-6120	258	126	188
Paratype, USNM 128104. Adult left valve, sta. B-6120	287	156	92
Paratype, SDNH 04214. Adult right valve, sta. B-6120	277	151	75
Paratype, SDNH 04215. Adult carapace, sta. B-6120	266	152	166
Paratype, SDNH 04216. Adult left valve, sta. B-8558	191	164	100
Paratype, SDNH 04217. Adult carapace, sta. B-6120	285	167	177

Discussion. — Two basic forms are present probably reflecting sexual dimorphism. The males are compressed dorsally and swollen at the subcentral and posteroventral areas, as shown in text figure 16a-b. These tend to be arrow-shaped in dorsal view as a result of the pronounced posteroventral swellings. The presumed females are more abundant and more

inflated laterally, but are no wider, and tend to be lenticular in dorsal view. Holden (1964:413) noted a similar kind of dimorphism in *Eucytherura spinata* from the Upper Cretaceous of California. The typical type of dimorphism in *Eucytherura* results in lower and longer males (Morkhoven, 1963:357).

Ornamentation is variably developed. In the inflated females, an arcuate row of about five or six tubercles runs from the eye tubercle to the posteroventral swelling via the subcentral area and then up to the posterodorsum (Figure 16g). In the males the tubercles are mostly lost at the expense of the various swellings.

One of the most prominent features is the large eye tubercles. The species appears to be related to *Eucytherura gibbera* Müller, 1894, which has a similar type of ornamentation

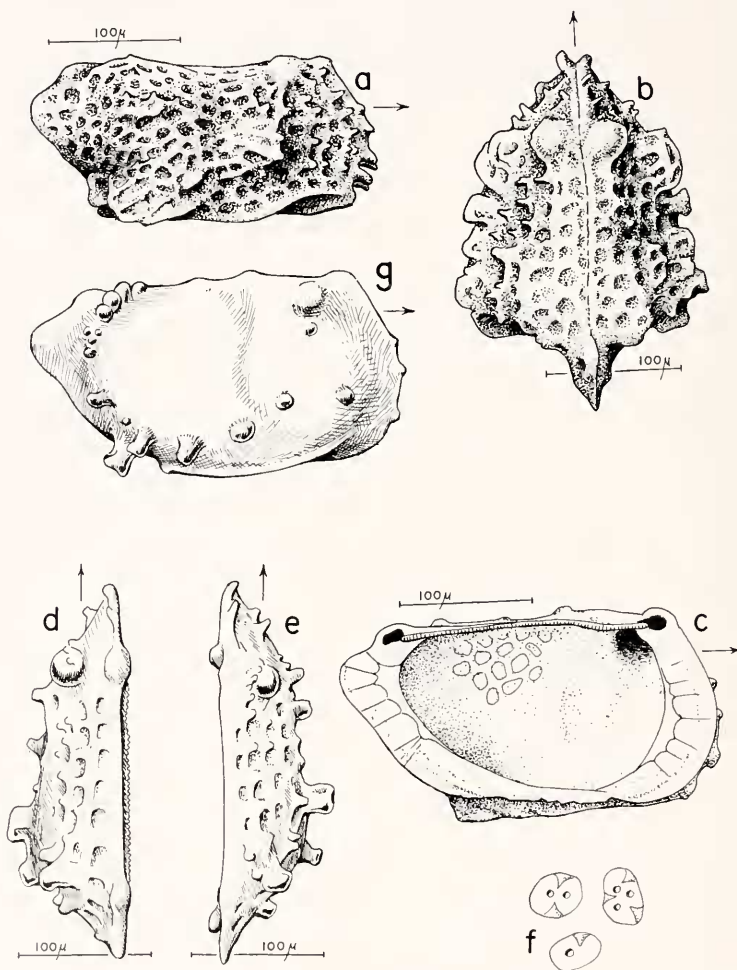


Figure 16. *Eucytherura binocula* sp. nov. a-b, holotype, USNM 128103; a, lateral left valve view of adult carapace; b, dorsal view of adult carapace. c-d, paratype, USNM 128104; c, interior view of adult left valve; d, dorsal view of adult left valve. e, paratype, SDNH 04214; dorsal view of adult right valve. f, normal pores within reticulæ as seen with transmitted light. g, generalized sketch showing tubercle arrangement on the female carapace, reticulæ not drawn in.

and large eye tubercles. According to Bold (pers. comm.) the species is similar but not identical to species living in the Caribbean.

The species is named with reference to its very large eye tubercles.

Genus *Paracytheridea* Müller, 1894

Paracytheridea tschoppi Bold, 1946

Figures 17, 18, 19

Paracytheridea tschoppi van den Bold, 1946:85, pl. 16, figs. 6-7; van den Bold, 1957:245, pl. 4, fig. 7; Benson and Coleman, 1963:33, pl. 6, figs. 7, 9, 10, 20.

Paracytheridea granti Swain, 1967:70 (in part), pl. 4, figs. 10, 11a, b, pl. 5, figs. 2a, b, 4a-c, 5, text fig. 47a.

Diagnosis.— Sharply and prominently caudate *Paracytheridea* with posterodorsal swelling supporting 3-4 flange-like oblique ridges, horizontal alar ridge continuous to anterior margin; posterior toothlet complex in hinge of right valve well developed; projecting anterior toothlet complex poorly developed and not projecting.

Description.— In side view: outline of dorsum and venter parallel due to posteroventer massive ala; dorsal and ventral margins actually highly and posteriorly acuminate, terminating in well developed pointed caudal process at posterior midheight; anterior margin of right valve broadly rounded, obliquely rounded in left valve due to extended anterocardinal wing. In dorsal view: greatest carapace width in posterior third, height/length ratio of 0.65 to 0.75. Valves deeply sulcate at midlength in dorsal three-quarters dividing subcentral tubercle and highly inflated posterodorsal swelling. Ornamentation principally of flange-like ridges characteristically arranged as discussed further on.

Duplicature wide, nonvestibulate duplicatures transected by sparse radial pore canals; radial pore canals mostly false, about 12 anteriorly, 3 posteriorly, one of which occupies conspicuous subcaudal denticle. Normal pores sieve type, sparse, sieve plate usually a horseshoe shaped structure with about 25 perforations. Hinge lobodont, right valve with prominent posterior element of five distinct toothlets, anterior element of five poorly

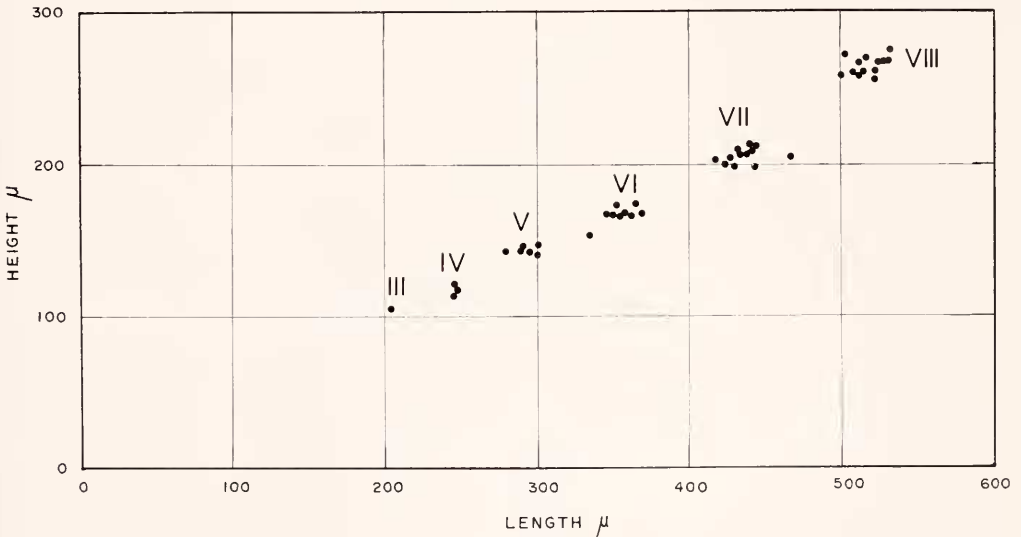


Figure 17. Length-height plot of six growth stages of *Paracytheridea tschoppi* Bold from stations B-6101 and B-6120. In all cases measurements were taken on entire carapace or the larger left valves.

developed toothlets, wavy median groove with about 20-25 notches. Five adductor muscle scars on posterior side of well developed circular subcentral depression, second and third scars up may be a divided scar preserving the fundamental pattern of four scars for the adductor group. Frontal scars located on anterior side of subcentral depression numbering six in two pairs of three, one group above the other.

Sexual dimorphism not observed.

Dimensions.— The following information was determined from a collection of 35 adult carapaces: $L = 520 \pm 20.6 \mu$; $H = 261 \pm 18.4 \mu$. Nineteen adult carapaces gave a mean width of 380μ with a range from 348μ to 405μ .

Dimensions.—

	Length	Height	Width
Hypotype, USNM 128074. Adult right valve, sta. B-6101	514	241	192
Hypotype, USNM 128074. Adult left valve, sta. B-6101	517	267	192
Hypotype, SDNH 04218. Adult carapace, sta. B-6101	524	251	360
Hypotype, SDNH 04219. Adult carapace, sta. B-6101	530	275	367
Hypotype, SDNH 04220. Penultimate carapace, sta. B-6101	449	209	300
Hypotype, USNM 128075. Penultimate left valve, sta. B-6101	430	204	150
Hypotype, USNM 128076. 6th instar carapace, sta. B-6101	364	167	237
Hypotype, USNM 128077. 5th instar carapace, sta. B-6101	300	142	203
Hypotype, USNM 128078. 4th instar carapace, sta. B-6100	203	102	143

Discussion.— *Paracytheridea tschoppi* has not previously been reported from the Pacific region though it is known to be widespread in the Caribbean and parts of the Gulf of Mexico (Bold, 1946, 1957; Benson and Coleman, 1963). We believe that minor differences in shell morphology are not sufficient evidence to separate the closely related populations of *P. tschoppi* in the Gulf of California and Clipperton Island from those in the Caribbean and Gulf of Mexico.

Terminology is introduced in Figure 18 for the ridge arrangement of *Paracytheridea*. It is assumed that the positions, if not the degree of development, of ridges ornamenting the valves of this genus are genetically controlled.

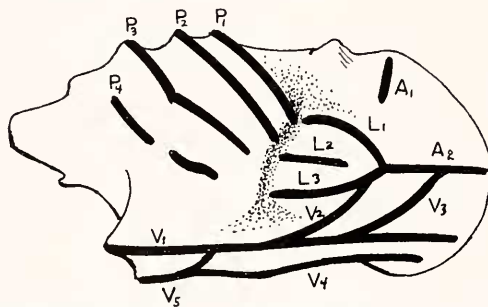


Figure 18. Schematic diagram of *Paracytheridea* ornamentation. A, L, P, and V represent the anterior, lateral, posterior, and ventral ridges, respectively.

The Pliocene to Holocene *Paracytheridea granti* Le Roy, 1943 of California and Baja California has been confused with *P. tschoppi*. *Paracytheridea granti* lacks the pronounced posterodorsal swelling and possesses a more prominent posterodorsal cardinal angle than *P. tschoppi*. In *P. tschoppi* a P_2 or P_3 extends into the posterocardinal region. Ridge ornamentation in *P. granti* is distinctive with a P_2 or P_3 running continuously into L_1 which joins A_2 and which is the only horizontal ridge reaching the anterior margin. In *P. tschoppi*, both A_2 and V_1 reach the anterior margin. In *P. granti* V_1 ultimately joins V_3

and merges with A_2 .

Paracytheridea tschoppi is characterized by a ridge arrangement as follows: P_2 is well developed and bifurcates near the median sulcus and can be traced, or extrapolated, across the sulcus to L_1 and L_2 respectively. P_4 is interrupted medially and is traceable to L_3 . L_1 and L_3 merge in the anterior part of the subcentral tubercle and join A_2 which continues to the anterior margin. A strongly developed V_1 is continuous from the posterior end of the alae to the anterior margin and is subparallel with L_3 - A_2 in the anterior half of the shell. V_1 and V_2 are equally developed.

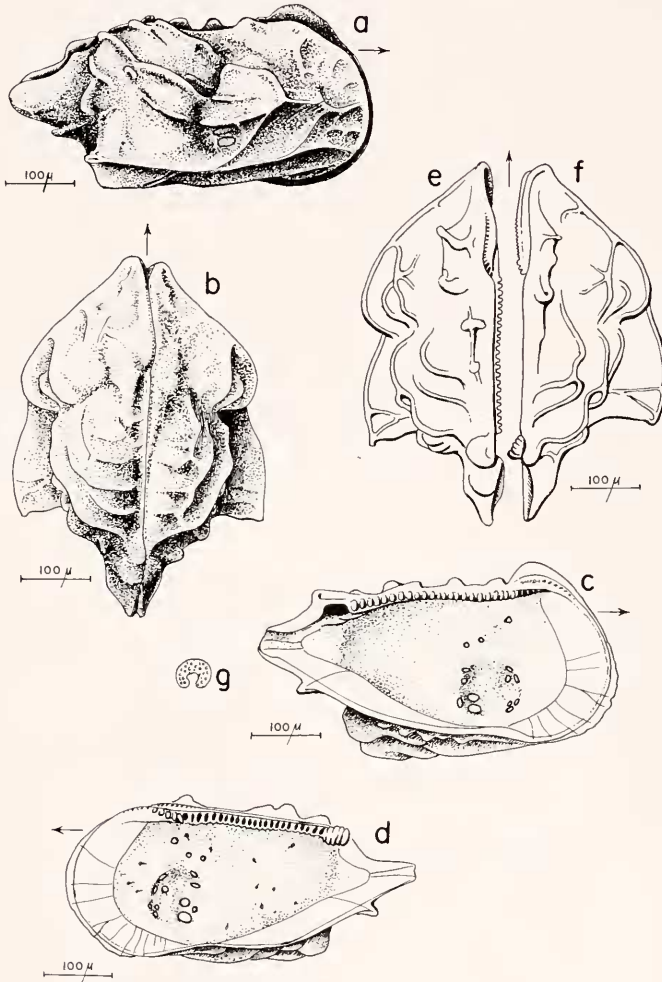


Figure 19. *Paracytheridea tschoppi* Bold, 1946. a, hypotype, SDNH 04219; lateral right valve view of adult carapace. b, hypotype, SDNH 04218; dorsal view of adult carapace. c-f, hypotype, USNM 128074; c, interior view of adult left valve; d, interior view of adult right valve; e, f, dorsal view of adult right and left valves respectively, normal pore greatly enlarged as seen with transmitted light.

Genus *Semicytherura* Wagner, 1957***Semicytherura quadraplana* sp. nov.**

Figure 20

Diagnosis. — Small *Semicytherura* with high pointed caudal process and ridge ornamentation resulting in minutely pitted posteroventral, anteroventral, and central fields when viewed from the side; alate as seen from above.

Description. — Carapace heavy, small, 260 to 290 μ long. In side view: dorsal margin nearly straight, parallel with straight ventral margin; venter very wide and flat; anterior margin obliquely rounded, ventral half with four stubby marginal knobs; posterior margin truncate beneath high, pointed caudal process; periphery of valves with continuous smooth ridge, doubled along anterior margin and complex along dorsal margin; smooth lateral ridge departing at right angle from anterior ridge at midheight, swinging down to venter along the edge of wide alar process, then swinging irregularly back up to postero-cardinal angle thus creating two nearly equal fields in anteroventer and posteroventer with larger central field between; compressed caudal area a fourth field; right valve somewhat higher, overreaching left valve along dorsum. In dorsal view: carapace compressed in dorsal half; greatest width along ventral midlength on well developed alar process; anterior blunt due to doubled marginal ridge system; posterior compressed, pointed at caudal process.

Duplicatures broad; posterior duplicature greatly extended inward, almost to middle of valve; posterior radial pore canals mostly false, some passing through marginal spine at posteroventer, at least one running full length of caudal process; anterior duplicature wide, with 15 to 20 irregular, enlarged, sometimes dividing radial pore canals; no vestibules. Normal pores numerous, tiny, in small clusters of one to 18, each cluster apparently narrowing to small external pit. Hinge elements of right valve consist of smooth anterior tooth, flange-like posterior tooth, and crenulate median groove. Four oblong adductor muscle scars form vertical row in lower half of valve; elongate single frontal scar anterior to topmost adductor scar.

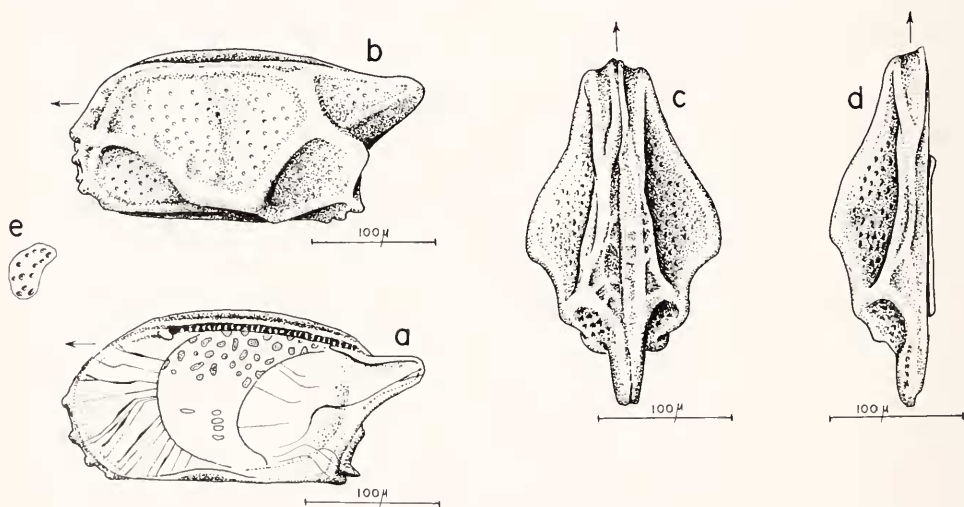


Figure 20. *Semicytherura quadraplana* sp. nov. a, paratype, USNM 128106; internal view of adult right valve. b, holotype, USNM 128105; external left valve view of adult carapace. c, paratype, SDNH 04221; dorsal view of left valve. e, enlarged view of normal pore cluster as seen with transmitted light.

Dimensions. —

	Length	Height	Width
Holotype, USNM 128105. Adult carapace, sta. B-6100	289	132	137
Paratype, USNM 128106. Adult right valve, sta. B-6100	275	133	70
Paratype, SDNH 04221. Adult left valve, sta. B-6100	276	129	73
Paratype, SDNH 04222. Adult carapace, sta. B-6100	267	129	140
Paratype, USNM 128107. Adult carapace, sta. B-6100	276	136	137
Paratype, SDNH 04223. Adult carapace, sta. B-6100	277	133	134
Paratype, SDNH 04224. Adult carapace, sta. B-6100	269	129	134

Discussion. — The ridge arrangement of *Semicytherura quadraplana* is somewhat similar to that found on *S. quadrata* (Hanai, 1957:20) from Japan, though these species differ in other aspects. The strongly developed alae set this new species apart from any known *Semicytherura*. The unique ridge arrangement is a result of the singular lateral ridge following each ala to the venter from anterior and posterior midheights.

Family Hemicytheridae Puri, 1953

Genus *Mutilus* Neviani, 1928

***Mutilus convergens clippertonensis* subsp. nov.**

Figure 21, 22

Aurila convergens Swain, 1967:79, pl. 8, fig. 8; Gunther, 1967:97, pl. 1, fig. 8.

Diagnosis. — A species of *Mutilus* with highly arched dorsum, well developed posterodorsal tubercle, prominent ornamental ridge and furrow from posterodorsum to anteroventer across dorsolateral-antrolateral areas.

Description. — In side view: margins rounded except at small pointed caudal process near

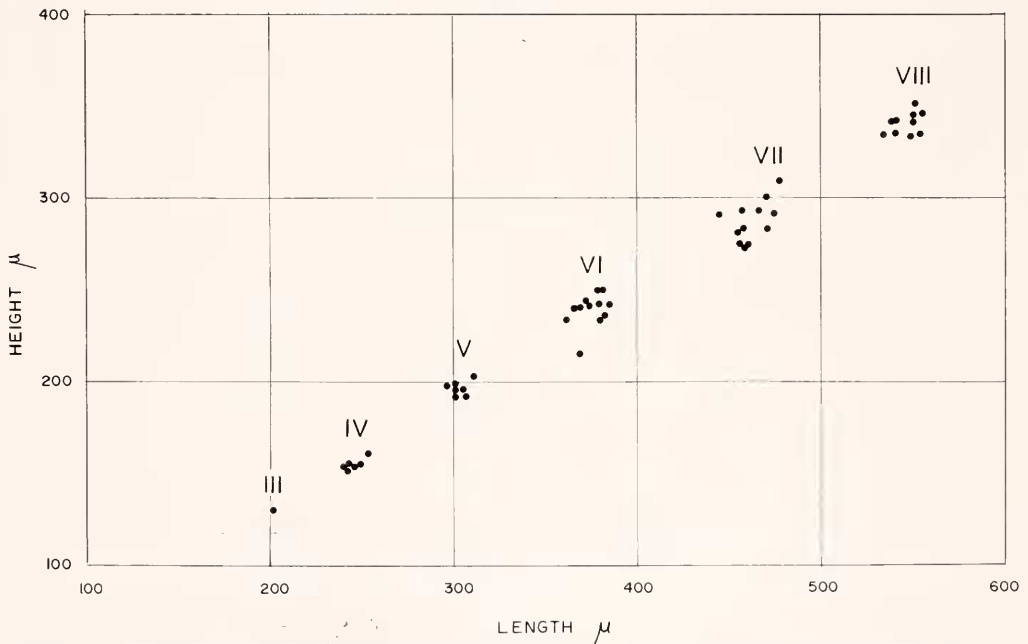


Figure 21. Length-height plot of six growth stages of *Mutilus convergens clippertonensis* subsp. nov. from stations B-4241, B-6101, and B-6100. All measurements taken on complete carapaces or the larger left valves. Labeling of the instars assumes that the species has eight growth stages.

posteroventer beneath slightly concave posterior; dorsum gently rounded, continuous with obliquely rounded anterior margin; ventral margin sinuous, slightly concave downward at inturned area; right valve somewhat larger than left valve, overreaching left valve along posterior, dorsum, and part of anterior margins; prominent angled posterodorsal tubercle at juncture of ornamental ridges. Ornamentation of six horizontally trending ridges with large reticulations in intermediate furrows; two parallel sinuous ridges extend from posteroventer to anteroventer; prominent ridge and furrow from posterodorsal tubercle to anteroventer via dorsolateral-anterolateral areas. In dorsal view: carapace lenticular, greatest width at midlength; anterior and posterior blunt. Eye tubercles small, on heavy marginal rim system. Males present but shell dimorphism not apparent.

Duplicature about $50\ \mu$ wide, continuous along venter. Radial pore canals abundant,

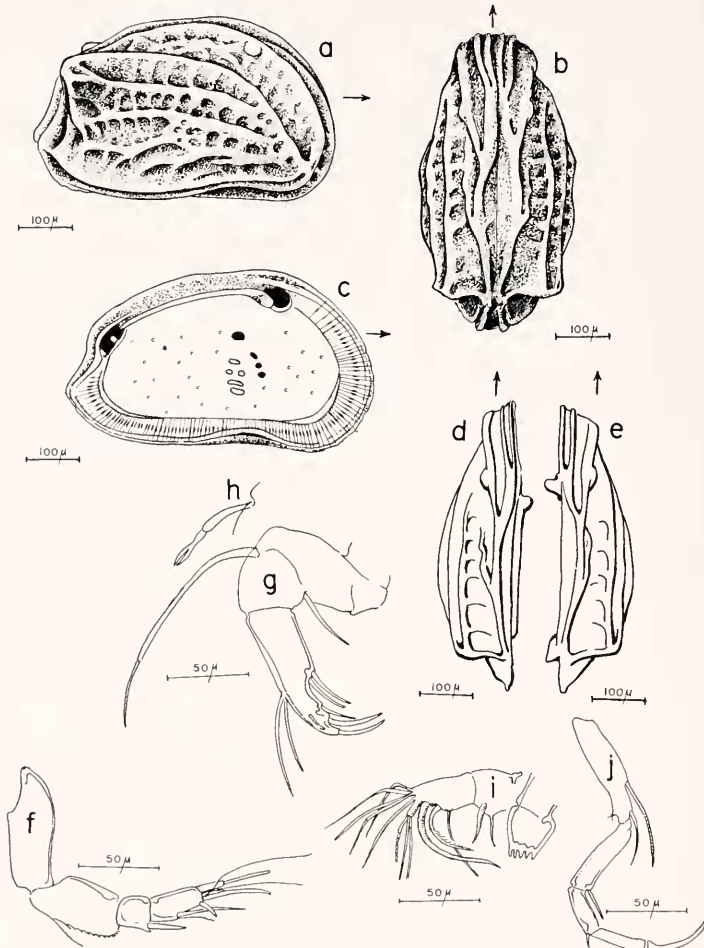


Figure 22. *Mutilus convergens clippertonensis* subsp. nov. a-b, paratype, USNM 128109; a, external right valve view of adult carapace; b, dorsal view. c, holotype, USNM 128108; internal view of adult left valve. d, paratype, SDNH 04226; dorsal view of adult left valve. e, paratype, SDNH 04225; dorsal view of adult right valve. f, 1st antenna (incomplete). g, male 2nd antenna with long spineret bristle. h, female, 2nd antenna in part showing reduced spineret bristle. i, mandible and maxilla. j, 1st thoracic leg.

evenly spaced, straight, unpaired, each with small midswelling; vestibules shallow. Normal pores large, sparse, sieve type. Hinge amphidont; anterior tooth of right valve stepped; posterior tooth of right valve bifid in ventral part; median bar and tooth of left valve smooth. Four adductor muscle scars, second scar from top distinctly divided into two equal smaller scars; oblique row of three mandibular scars located anterior to top two adductor scars; conspicuous oblong scar directly above adductor group in dorsal half of valve.

Dimensions. — The dimensions of the adults, based on the analysis of 50 carapaces and larger left valves, are: $L = 544.0 \pm 19.2 \mu$, $H = 331.5 \pm 18.8 \mu$; $W = 264.0 \pm 18.8 \mu$. The arithmetic mean widths of the instars VII, VI, V, and IV are 215μ , 169μ , 136μ , and 103μ respectively. Lengths and heights of the young are shown in figure 21.

	Length	Height	Width
Holotype, USNM 128108. Adult left valve, sta. B-6120	558	346	150
Paratype, USNM 128109. Adult carapace, sta. B-6120	550	345	296
Paratype, SDNH 04225. Adult right valve, sta. B-6120	537	316	142
Paratype, SDNH 04226. Adult left valve, sta. B-6120	542	335	150
Paratype, USNM 128110. 7th instar carapace, sta. B-6101	456	281	218
Paratype, USNM 128111. 6th instar carapace, sta. B-6101	380	234	183
Paratype, SDNH 04227. 5th instar carapace, sta. B-6100	302	195	133
Paratype, SDNH 04228. 4th instar carapace, sta. B-6100	242	158	103

Discussion. — Almost 1000 specimens were counted and examined. The species is by far the most abundant ostracode living in the shallow marine environments around Clipperton Island from shoreline to depths of 40-45 m. It is still relatively abundant at 92 m, however, this may be an artifact of redeposition as no living individuals were found at that depth. The few specimens from Sta. B-4244-47 were all dead and we assume that they may have lived there at a time prior to the enclosing and freshening of the inner lagoon.

The Clipperton Island specimens are assigned to a species occurring in the Gulf of California (Swain, 1967) and the Gulf of Panama (Günther, 1967). The most distinctive, and apparently unique, feature of the valve is an ornamental furrow running from the posterodorsum to the anteroventer; this is highly developed in the Clipperton Island subspecies. *Mutilus convergens* is closely related to *M. palosensis* LeRoy (1943) from California and the west coast of Baja California (Benson, 1959) and to the fossil Hawaiian Island *M. oahuensis* Holden (1967). This group is characterized by a well developed posterodorsal ridge juncture, a sinuous ventral margin paralleled by one or two ventrolateral ridges, and a tendency for the lateral ridges to converge anteroventrally. All of these ornamental and morphological conditions are more prominently developed in the Clipperton species than in any other.

Family Limnocytheridae Klie, 1938

Genus *Limnocythere* Brady, 1868

Limnocythere viaticum sp. nov.

Figure 23

Diagnosis. — Carapace fragile, small, less than 400μ long; lightly reticulate and punctate; reniform-shaped as seen in side view; large dorsolateral swelling in front of median sulcus, smaller swelling below, at center of valve; anterior wedge-shaped and sharply pointed as seen from above.

Description. — In side view: shell reniform, ventral margin broadly concave, dorsal margin straight to slightly arched; anterior and posterior margins broadly rounded; surface of valves lightly reticulate in posterolateral and ventrolateral areas, lightly pitted in

anterior and on swellings; large swelling above smaller one between two dorsolateral sulci; antermost sulcus irregular, poorly developed; postermost sulcus well developed, vertical; third dorsolateral swelling behind postermost sulcus poorly developed; small fourth swelling on posterior part of ventrolateral inflation; left valve slightly larger, and overreaching right valve anteriorly and posteriorly. In dorsal view: greatest width in posterior half at ventrolateral swelling; posterior half of carapace inflated; anterior half wedged shaped, pointed.

Duplicature narrow, traversed by sparse, evenly spaced radial pore canals, about 15 posteriorly and anteriorly. Four oblong adductor scars in vertical row in ventral half of valve; single mandibular scar ventral and anterior to adductor group; single frontal scar anterior and dorsal to adductor group. Hinge weak, left valve with terminal depressions (sockets) near cardinal angles.

Dimensions.—

	Length	Height	Width
Holotype, USNM 128112. Adult carapace, sta. B-4244, 47	372	213	184
Paratype, USNM 128113. Adult right valve, sta. B-4244, 47	366	203	75
Paratype, SDNH 04229. Adult carapace, sta. B-4244, 47	358	203	166
Paratype, SDNH 04230. Adult carapace, sta. B-4244, 47	363	212	182
Paratype, SDNH 04231. Adult carapace, sta. B-4244, 47	375	216	179
Paratype, SDNH 04232. Adult right valve, sta. B-4244, 47	363	216	175

Discussion.— *Limnocythere viaticum* is one of three freshwater species found in Clipperton lagoon. The taxon cannot be identified with any known species, though the

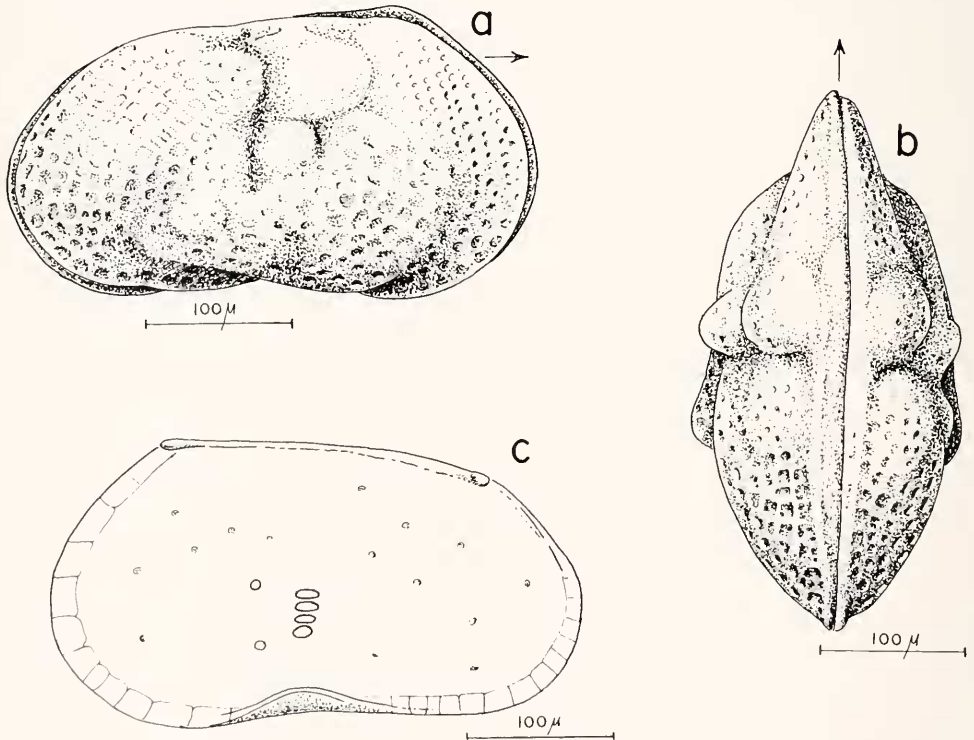


Figure 23. *Limnocythere viaticum* sp. nov. a-b, holotype, USNM 128112; a, lateral right valve view of adult carapace; b, dorsal view of adult carapace. c, paratype, USNM 128113; interior view of adult right valve.

freshwater ostracode faunas of Central America, where one might expect these to have originated, are very poorly known.

As discussed elsewhere, the freshwater lagoon is a relatively recent phenomenon. The specific name alludes to the species, or its ancestors, trip to the island: *viaticum* (L.) "voyager."

Family Paradoxostomatidae Brady and Norman, 1889

Genus *Paradoxostoma* Fischer, 1855

***Paradoxostoma limbaughi* sp. nov.**

Figure 24

Diagnosis.—Elongate *Paradoxostoma* posteriorly terminating at midheight in blunt point; greatest carapace height in posterior half; dorsal view of carapace lenticular and symmetrical except for bluntly pointed anterior.

Description.—Shell fragile, transparent; relatively small for genus, length about 340 μ . In side view: carapace elongate, length $2\frac{1}{2}$ times height; highest point of carapace just posterior to midlength at broadly arched dorsum; posterodorsal margin flattened; posterior margin bluntly pointed at midheight; ventral margin broadly concave downward at inturned area in anterior half, broadly rounded in posterior $2/3$ of valve. In dorsal view:

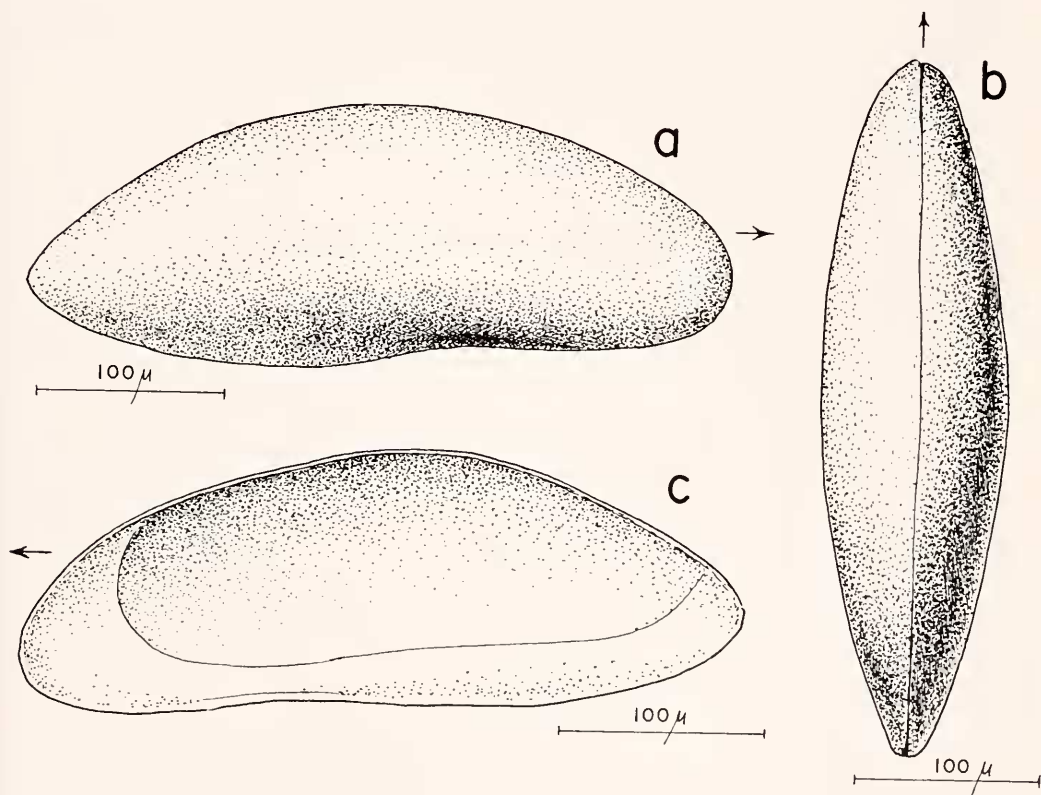


Figure 24. *Paradoxostoma limbaughi* sp. nov. a-b, holotype, USNM 128114; a, lateral right valve view of adult carapace; b, dorsal view of adult carapace. c, paratype, USNM 128115; interior view of adult right valve.

outline symmetrically lenticular except for bluntly pointed anterior; greatest width at midlength. Internal features not discernible.

<i>Dimensions.</i> —	<i>Length</i>	<i>Height</i>	<i>Width</i>
Holotype, USNM 128114. Adult carapace, sta. B-4241	341	127	90
Paratype, USNM 128115. Adult right valve, sta. B-4241	328	129	50
Paratype, USNM 128116. Adult carapace, sta. B-4241	326	134	92
Paratype, SDNH 04233. Adult carapace, sta. B-4241	334	130	87
Paratype, SDNH 04234. Adult carapace, sta. B-4241	338	135	92
Paratype, SDNH 04235. Adult carapace, sta. B-4241	340	137	93

Discussion.— The species apparently belongs in the genus *Paradoxostoma* based on general morphology; however, it is possible that it could be placed in *Xiphicilus* which is usually more pointed at both ends, or *Cytheroïs* which is less bluntly pointed.

The species is similar to *Paradoxostoma artum* Bold, 1966, from the Caribbean and *Xiphicilus* sp. cf. *X. arenatus* Brady from New Caledonia in the sense of Apostolescu, 1967.

The species is named for the late Conrad Limbaugh who helped collect the Clipperton Island samples.

Genus *Sclerochilus* Sars, 1866

Sclerochilus sp.

Figure 25

Sclerochilus contortus: Müller, 1894: 282, pl. 16, fig. 2.

Sclerochilus sp. B, Holden, 1967: 39, text figs. 30a-c.

Description.— In side view: shell reniform, with broadly and evenly arched dorsum; ventral margin sinuous, greatly rounded in posterior two-thirds, concave downward in anterior half; carapace relatively high, length/height ratio = 2.0, posterior bluntly pointed at midheight or broadly rounded. In dorsal view: carapace lenticular, compressed, length/width ratio = 2.7; greatest width at midlength, posterior and anterior pointed. Dimorphism not observed.

Duplicate wide; vestibules large; fused zone narrow, with continuous width of about 15 μ . Radial pore canals simple, numbering 20 to 30 throughout duplicature. Normal pores open, small, sparse. Five adductor muscle scars in oblong oblique pattern at midheight of valve just anterior to midlength.

<i>Dimensions.</i> —	<i>Length</i>	<i>Height</i>	<i>Width</i>
Specimen, USNM 128079. Adult right valve, sta. B-6120	421	210	71
Specimen, USNM 128080. Adult left valve, sta. B-6120	408	208	73
Specimen, SDNH 04236. Adult left valve, sta. B-6120	383	190	75
Specimen, SDNH 04237. Adult right valve, sta. B-6120	398	193	65
Specimen, SDNH 04238. Penultimate carapace, sta. B-6120	350	176	135

Discussion.— These specimens are identical to *Sclerochilus* sp. B (Holden, 1967) from late Cenozoic drowned terraces in the Hawaiian Islands, and to a form from the Mediterranean identified by Müller (1894) as *S. contortus* (Norman). Müller's illustrations (pl. 16, figs. 1–2) of this form show distinct sexual dimorphism, the males being the lower and relatively more elongate of the two. *Sclerochilus* sp. is similar to the female, illustrated by Müller, but not to the male. These specimens, including Müller's are considered distinct from *S. contortus* (a North Atlantic species) based on differences in the morphology of the shell. Whether only females have been found at Clipperton Island or whether the population

there shows no sexual dimorphism is unknown. Unfortunately the soft parts were not preserved.

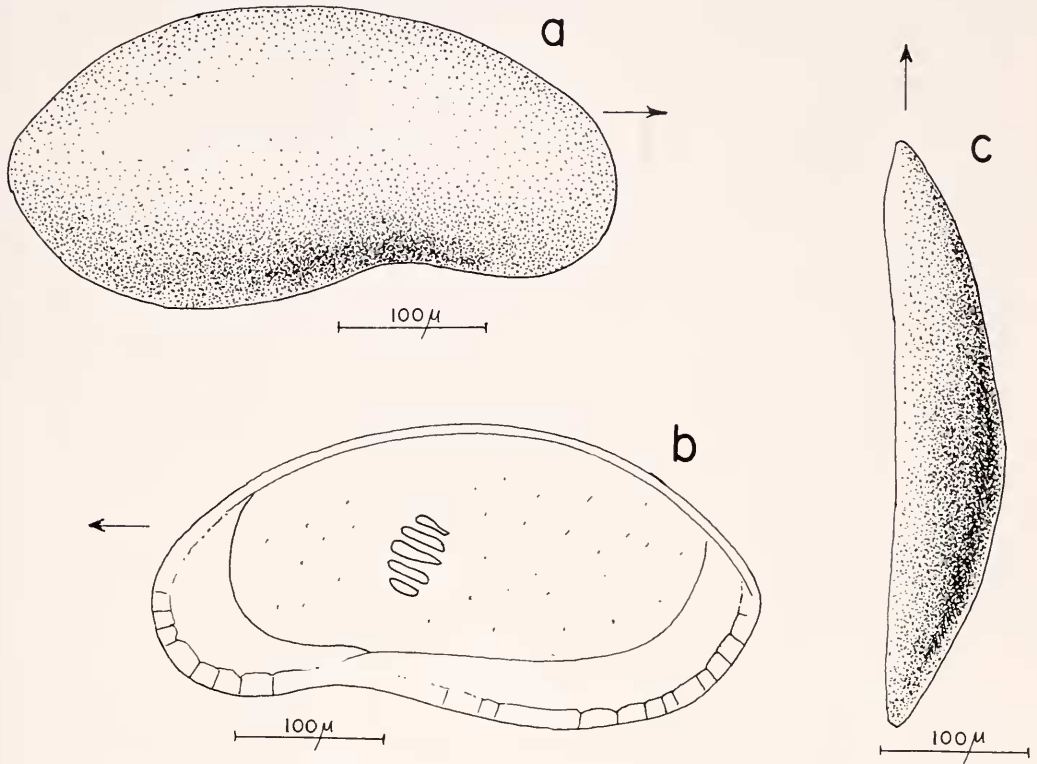


Figure 25. *Sclerochilus* sp. a-c, specimen, USNM 128079; a, lateral view of adult right valve; b, dorsal view of adult right valve; c, interior view of adult right valve.

Family Trachyleberididae Sylvester-Bradley, 1948

Genus *Neocaudites* Puri, 1960

Neocaudites pacifica pacifica sp. nov.

Figure 26

Diagnosis. — Moderate size *Neocaudites*, length to $559\ \mu$, ornamented with large shallow reticulations; distinctive, isolated, denticulate, submarginal ridge, paralleling anterior margin; valves asymmetric with dorsal and lateral ridge juncture at posterodorsum more posteriorly extended in right than left valve. Frontal scar v-shaped, three adductor scars.

Description. — In side view: carapace subquadrate, dorsal margin irregular to straight, subparallel with gently concave ventral margin; anterior margin broadly rounded, finely and evenly denticulate in ventral half; posterior subtruncate, with low, bluntly pointed, caudal process; left valve overlapping right valve at postero- and anterocardinal angles. Ornamentation of large shallow reticulations; marginal rim continuous from anterocardinal angle around anterior, along venter, around posterior; lateral field with smooth, straight centrolateral ridge extending from posterodorsal area to low, inconspicuous subcentral tubercle; prominent, narrow submarginal ridge in anterolateral area, paral-

leling anterior margin; broad, shallow vertical sulcus anterior to midlength; eye tubercles small, prominent. In dorsal view: carapace compressed, width/length ratio = 0.30, carapace of equal width from subcentral region to posterocardinal region; caudal and anterior parts compressed; valves asymmetric: right valve with more posteriorly extended ridge juncture.

Duplicature moderately broad, shallow vestibule irregularly shaped. Radial pores sometimes branched, commonly with midswellings, about 30 in anterior, 25–30 in posterior. Normal pores small, sieve type. Hinge holamphidont; left valve with entire, projecting, stepped anterior tooth; entire reniform posterior tooth. Smooth median bar of left valve with low, smooth anterior tooth. Three oblong adductor muscle scars on posterior side of subcentral depression; bottom-most scar apparently a fused pair. Large V-shaped frontal scar anterior to top-most adductor scar on side of subcentral depression. Single circular mandibular scar beneath frontal scar.

<i>Dimensions.</i> —	<i>Length</i>	<i>Height</i>	<i>Width</i>
Holotype, USNM 128117. Adult right valve, sta. B-6120	524	260	75
Holotype, USNM 128117. Adult left valve, sta. B-6120	524	270	89
Paratype, SDNH 04239. Adult right valve, sta. B-6120	523	253	81
Paratype, SDNH 04239. Adult left valve, sta. B-6120	533	266	92
Paratype, SDNH 04240. Adult carapace, sta. B-8558	600	318	184
Paratype, USNM 128118. Adult carapace, sta. B-8558	508	312	191
Paratype, USNM 128119. Adult carapace, sta. B-8558	559	302	175
Paratype, SDNH 04241. 6th instar, sta. B-6120	414	224	141
Paratype, SDNH 04242. 5th instar, sta. B-6120	350	183	146

***Neocaudites pacifica minima* subsp. nov.**

Figure 26

Diagnosis.— Small, length about 450 μ , ornamented with various sized reticulations and pits; small, isolated, denticulate, submarginal ridge paralleling anterior margin; valves asymmetric with dorsal and lateral ridge juncture at posterodorsum more posteriorly extended in right valve; frontal scar s-shaped, four adductor scars.

Description.— Except for the differences stated in the diagnosis above, all other morphological details of *N. pacifica pacifica* are the same as those of this subspecies.

<i>Dimensions.</i> —	<i>Length</i>	<i>Height</i>	<i>Width</i>
Paratype, USNM 128120. Adult carapace, Hanauma Bay, Hawaiian Islands	424	217	144
Paratype, SDNH 04243. Adult left valve, Hanauma Bay	458	216	100
Paratype, SDNH 04243. Adult right valve, Hanauma Bay	458	209	95

Discussion.— *Neocaudites pacifica minima* from Hanauma Bay, Oahu, Hawaii, is believed to be subspecifically related to *N. pacifica pacifica* from Clipperton Island and is diagnosed here for comparative purposes. The most apparent difference between the two is that of size, *N. pacifica minima* being much smaller (length 450 μ) than that of *N. pacifica pacifica* (length = 525 μ). The Clipperton Island form occurs in deeper waters than the Hawaiian Island form (10 m). At Clipperton, it was collected alive at locality B-6120 (40–45 meters) and dead at locality B-8558 (92 meters).

The genus *Neocaudites* has been characterized as a Caribbean taxon (McKenzie, 1967: 232). Previously, only one species had been reported from the Pacific basin, *N. terryi* from off the Hawaiian Islands on submarine terraces. Although *N. terryi* is generally

similar to *N. pacifica*, its surface ornamentation is smooth rather than reticulate or pitted.

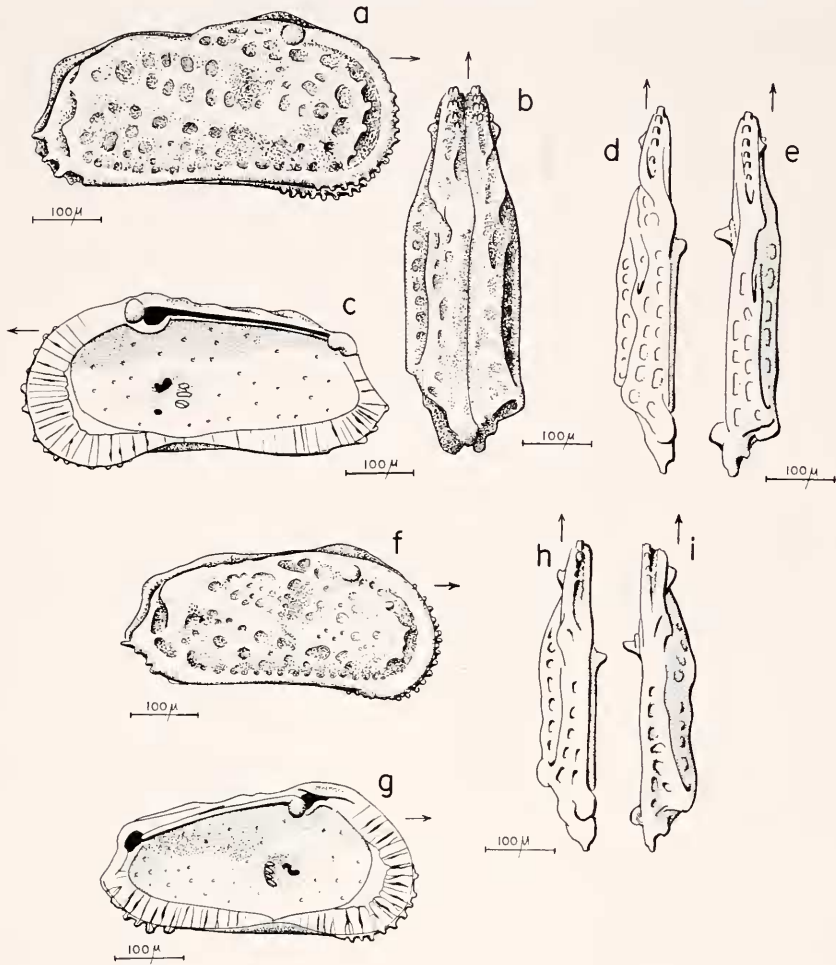


Figure 26. *Neocaudites pacifica* sp. nov. a-c, holotype, USNM 128117; a, external right valve view of adult male carapace; b, dorsal view; c, internal view of right valve. d-e, paratype, SDNH 04239; d, dorsal view of adult male left valve; e, dorsal view of right valve. *Neocaudites pacifica minima* subsp. nov. f, holotype, USNM 128120; external right valve view of adult female carapace; g-i, paratype, SDNH 04243; g, internal view of adult male left valve; h, dorsal view of left valve; i, dorsal view of right valve.

Genus *Occultocythereis* Howe, 1951
Occultocythereis angusta Bold, 1963

Figure 27

Cythereis deformis Brady, 1911: 597, pl. 20, figs. 7-8; not *Cythereis deformis* Baird, 1850: 256, pl. 18, figs. 4-6.
Occultocythereis angusta Bold, 1963: 391, pl. 9, figs. 1a-c, pl. 12, fig. 6 new name for *Cythereis deformis* Brady.

Diagnosis. — *Occultocythereis* with posterodorsal tubercle and posteroventral marginal rim heavy; dorsal rim weakly developed; lateral surface ornamentation very weakly developed; dorsal margin concave as seen from the side.

Description.— In side view: carapace small, length $450\ \mu$; length/height ratio = 2.0; highest point at anterocardinal angle in anterior third at midlength; dorsal margin straight between elevated cardinal angles; ventral margin straight or slightly irregular; anterior margin evenly and broadly rounded, with several well-developed denticles; larger left valve over-reaching right valve along venter, posterior, and at anterocardinal hinge angle; left valve asymmetric with elongate flange extending beneath valve along posteroventer margin; broad, flattened anterior marginal rim continuous from poorly developed eye tubercle to ventral inturned area; posteroventral area with complex massive tubercles; posterocardinal angle occupied by large dimpled tubercle; valves conspicuously sulcate at midlength; surfaces generally smooth between narrow, inconspicuous, serpentine ridges in lateral areas. In dorsal view: greatest width in posterior third at ridge juncture terminating in small, posteriorly pointing, lateral spine, anterior bluntly pointed due to thick antero-marginal rim; posterior compressed behind posterocardinal tubercles.

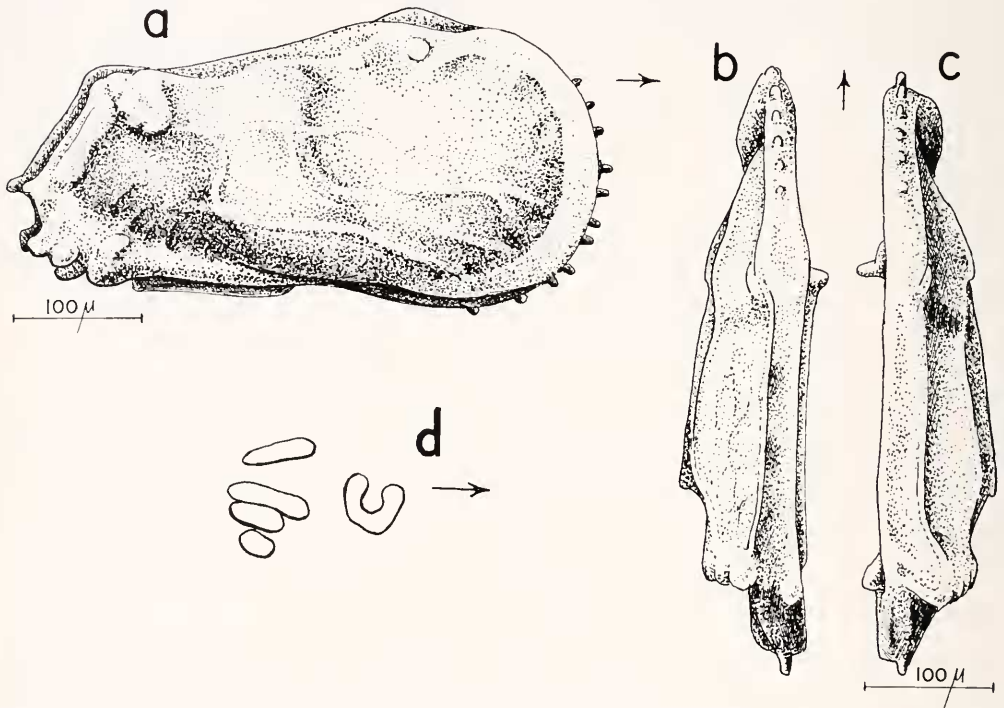


Figure 27. *Occultocythereis angusta* Bold, 1963. a-d, hypotype, USNM 128081; a, lateral right valve view of carapace; b, dorsal view of adult left valve; c, dorsal view of adult right valve; d, adductor muscle scar pattern of left valve.

Duplication of moderate width; vestibulae well developed, line of concrescence irregular and forming pockets into fused zone from which emanate straight, simple, abundant radial pore canals, about 30 in anterior; normal pores large, sparse, sieve type. Muscle scar pattern as shown in Figure 27d.

Dimensions.—

Hypotype, USNM 128081. Adult carapace, sta. B-6120

Length	Height	Width
461	229	183

Discussion.— *Occultocythereis angusta* is distinctive by the combination of features noted in the diagnosis. The dorsal ridge and lateral surface ornamentation is subdued, like that of

O. lineata (Müller, 1894) from the Mediterranean, in contrast to many of the early Tertiary species (Hinte, 1964; Triebel, 1961; Howe and Law, 1936; etc.). These two Recent species differ, *O. angusta* being smaller, relatively longer, and having a concave upward dorsal margin instead of a slightly convex one as shown by Müller (1894, pl. 29, fig. 21).

The Clipperton Island specimens more closely resemble the Caribbean form of *O. angusta* illustrated by Bold (1963b, pl. 9, fig. 1) and Teeter (1966, pl. 6, figs. 20–21) than the recent form from Madeira (Brady, 1911, pl. 20, figs. 7–8); however, the dissimilarities are slight and they appear to be conspecific.

Genus *Xestoleberis* Sars, 1866
Xestoleberis gracilis Brady, 1890

Figure 28

Xestoleberis gracilis Brady, 1890: 508, pl. 3, figs. 9–10.

Diagnosis.— A dorsoventrally compressed species of *Xestoleberis* with a broadly rounded dorsal margin and straight flat venter.

Description.— In side view: males similar in profile to females; carapace low, dorsoventrally compressed, length/height ratio = 2.5; ventral margin straight, flat; dorsal margin evenly and broadly rounded; anterior margin low, sharply rounded but not pointed; surface of valves smooth. In dorsal view: males lenticular, greatest width near midlength; females posteriorly inflated, greatest width in posterior quarter.

Posterior duplicature narrow; anterior duplicature of moderate width with narrow fused zone containing few (10 to 12) simple, straight, radial pore canals concentrated in ventral part. Normal pores large, especially abundant in anteroventer. Hinge typical for genus, terminal elements of right valve projecting crenulate plates, about 30 μ in length, separated by a smooth arcuate groove. Four large, oblong adductor scars in oblique row in anterior half at shell midheight; two frontal scars, one an arcuate bar, the other a spot anterodorsal to it, directly in front of top two adductor scars. Wide, arcuate, highly inclined, xestoleberid scar directly above adductor group near dorsum.

Dimensions.—

	<i>Length</i>	<i>Height</i>	<i>Width</i>
Hypotype, USNM 128082. Adult carapace, sta. B-6101	316	132	187
Hypotype, USNM 128083. Adult carapace, sta. B-6120	307	126	162
Hypotype, SDNH 04245. Adult left valve, sta. B-4241	308	129	123
Hypotype, SDNH 04246. Adult right valve, sta. B-4241	309	138	84
Hypotype, SDNH 04246. Adult left valve, sta. B-4241	324	151	93
Hypotype, SDNH 04247. Penultimate carapace, sta. B-4241	249	125	146
Hypotype, USNM 128084. Penultimate carapace, sta. B-4241	260	126	151

Discussion.— The species was originally described from Samoa living on reefs and intertidal pools (Brady, 1890). At Clipperton it is most common on the reef flat but one living specimen was found at 10–12 meters on the submerged terrace.

The species is somewhat similar to *Xestoleberis humilis* Klie, 1940, living in the "algalzone" along the west coast of Africa.

Xestoleberis sp. aff. *X. eulitoralis* Hartmann, 1959

Figure 29

Xestoleberis eulitoralis Hartmann, 1959b: 224, pl. 42, figs. 134–136; pl. 43, figs. 137, 138, 140, 141.

Xestoleberis cf. *X. eulitoralis*: McKenzie and Swain, 1967: 303, text fig. 34.

Description.— Carapace moderately compressed, surface of valves smooth; sexual di-

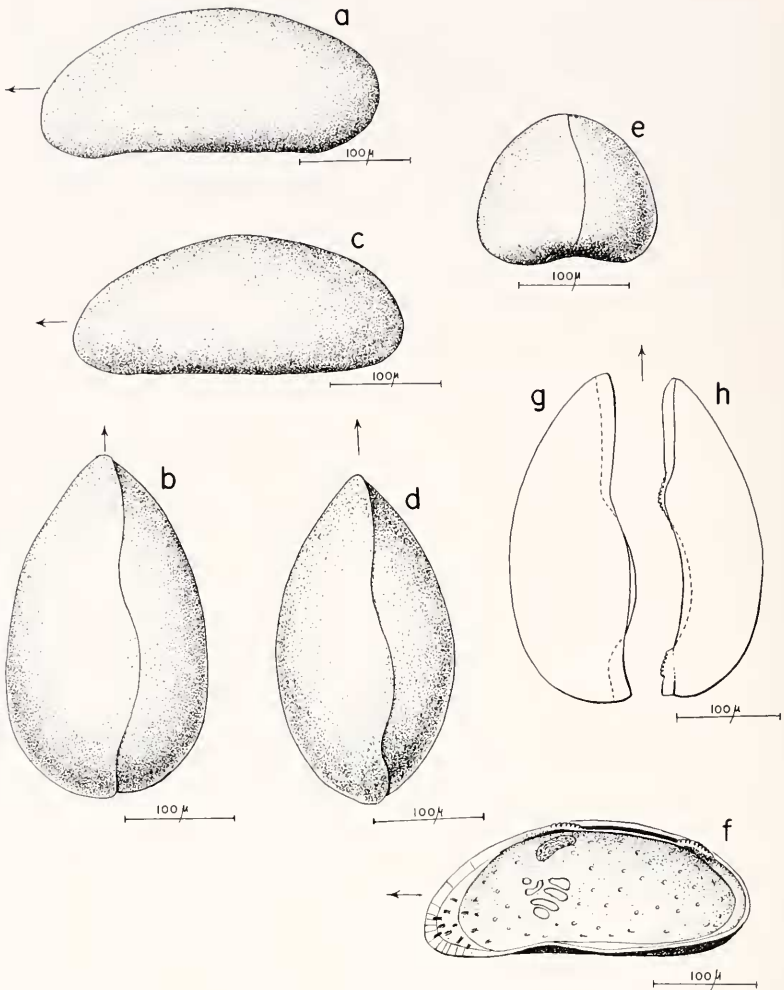


Figure 28. *Nestoleberis gracilis* Brady, 1890. a-b, hypotype, USNM 128082; a, left valve view of adult female carapace; b, dorsal view of adult female carapace. c-e, hypotype, USNM 128083; c, left valve view of adult male carapace; d, dorsal view of adult male carapace; e, anterior view of adult male carapace. f-h, hypotype, SDNH 04245; f, interior view of adult female right valve; g, dorsal view of adult female left valve; h, dorsal view of adult female right valve.

morphism not observed. In side view: valves suboblong, broadly rounded in outline, dorsal margin sloping slightly anteriorly; ventral margin straight; anterior and posterior margins bluntly rounded; carapace moderately compressed laterally, greatest inflation in ventral third; surfaces smooth. In dorsal view: carapace oblong, anterior and posterior bluntly rounded; greatest width at midlength.

Posterior duplicature narrow, entirely fused; anterior duplicature of moderate width, vestibulate. Radial pore canals simple, straight, equally spaced, numbering 20 in anterior, about 20 in posterior. Hinge typical for genus: smooth median bar of left valve almost straight as seen from above. Adductor muscle scar pattern a small vertical row of four elongate scars; single frontal scar directly anterior to topmost adductor scar.

Dimensions.—

	Length	Height	Width
Specimen, USNM 128085. Adult left valve, sta. B-6120	302	164	86
Specimen, SDNH 04244. Adult carapace, sta. B-6120	305	169	114
Specimen, USNM 128086. Adult left valve, sta. B-6120	300	164	82

Discussion.— The Clipperton Island specimens resemble *Xestoleberis* sp. cf. *X. eulitoralis* from Scammons Lagoon, Baja California, Mexico, more than they do the species from El Salvador which has no vestibule and has relatively complex radial pore canals. More and better preserved material would probably show this species to be conspecific to at least those from Scammons Lagoon.

At El Salvador *Xestoleberis eulitoralis* was found in the intertidal zone of Mejanguera Island, Gulf of Fonseca among rocks with corals, encrusting algae, barnacles, and oysters. McKenzie and Swain report their species occurring throughout Scammons Lagoon from 4 to 75 feet. At Clipperton Island three disarticulated valves were found at B-6120 (40–45 meters) and one at B-8558 (92 meters).

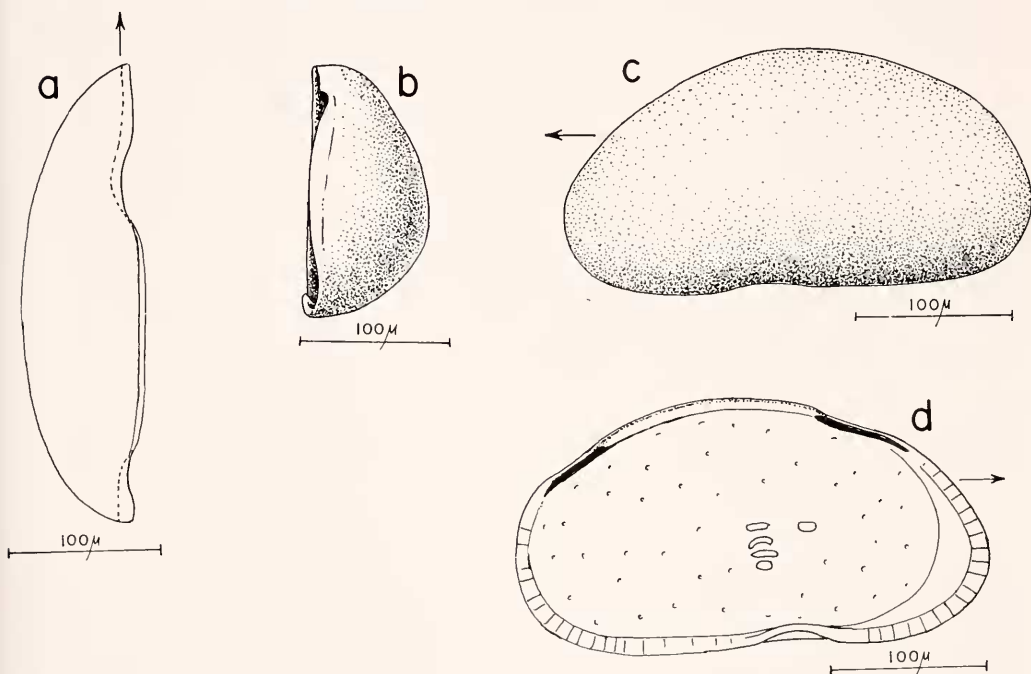


Figure 29. *Xestoleberis* sp. aff. *X. eulitoralis* Hartmann, 1959. a-d, specimen, USNM 128085; a, dorsal view of adult left valve; b, anterior view of adult left valve; c, lateral view of adult left valve; d, interior view of adult left valve.

Genus Uncertain

"*Cythere*" cf. "*C.*" *caudata* Brady, 1890

Figure 30

Description.— In side view: carapace elongate, length/height ratio=2.5; dorsal margin parallel to ventral margin throughout most of length; anterior margin broadly rounded; posterior with large compressed, bluntly pointed caudal process most of which lies beneath midheight. Shell ornamented with about 10 continuous and discontinuous glassy horizon-

tal ridges tending to parallel anterior margin. Caudal process and adjoining compressed parts of carapace smooth. In dorsal view: anterior sharply pointed; carapace midhalf parallel sided; posterior convex to highly compressed; caudal process of extreme posterior.

Internal features not observed.

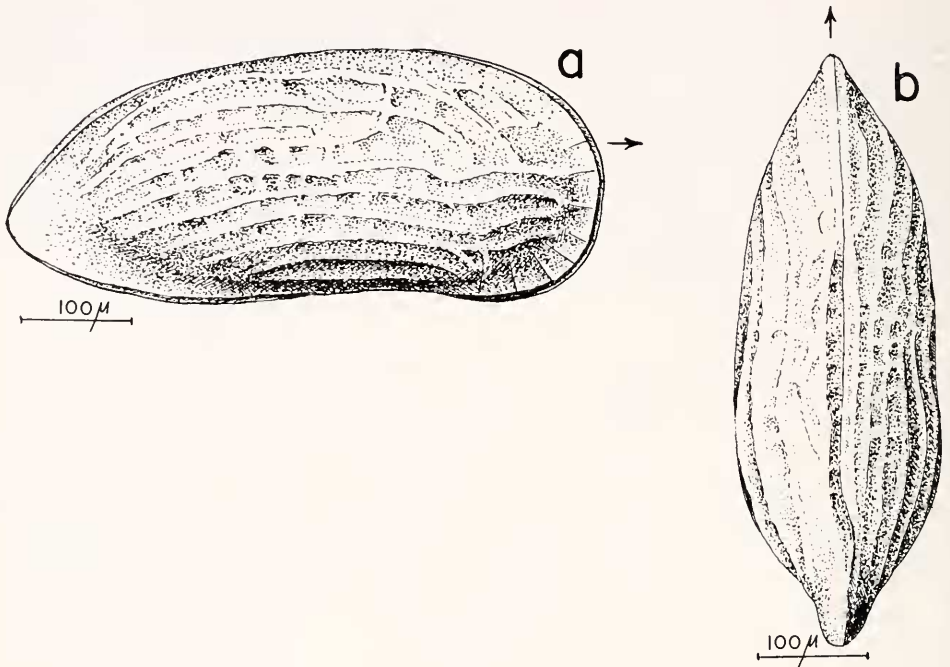


Figure 30. "*Cythere*" sp. cf. "*C. caudata* Brady, 1890. a-b, specimen, USNM 128087; a, right valve view of adult(?) carapace; b, dorsal view.

Dimensions.—

Specimen, USNM 128087. Entire specimen, sta. 8558

<i>Length</i>	<i>Height</i>	<i>Width</i>
540	230	180

Discussion.— Only one specimen was collected by the carousel dredge at 92 m. The species closely resembles *Cythere caudata* Brady, 1890 from Sava, Sava Bay, Fiji, and "*Cythere*" *caudata* from Manila (Keij, 1954) and Hawaii (Holden, 1967). The single entire carapace from Clipperton Island is larger than those mentioned above. Brady's and Keij's species are 460 μ and 450 μ respectively. The ones from Hawaii come from two populations, one fossil with an individual 410 μ in length and one from Hanauma Bay with very small adult individuals only 350 μ long. The Clipperton Island form is distinctive with well developed horizontal ridge ornamentation, the elongate reticulæ characteristic of the other related forms being defined between ridges. At the present time it is not possible to determine the specific relationships between the Clipperton forms and those described by other authors. All of the above species belong to an undescribed genus.

Suborder Platycopina Sars, 1866
 Family Cytherelloidea Sars, 1866
 Genus *Cytherelloidea* Alexander, 1929

Cytherelloidea praecipua Bold, 1963

Figure 31

Cytherelloidea praecipua van den Bold, 1963: 75, pl. 1, figs. 1-7.

Diagnosis.— Carapace reticulate, becoming smooth centrally; valves with poorly developed horizontal ridges; left valve with strong dorsal tooth fitting into large socket of right valve; large dorsal flange of right valve overlapping left valve at midlength.

Description.— In side view: carapace subquadrate; dorsal margin slightly rounded, somewhat irregular centrally at articulation; posterior margin truncate, anterior margin broadly rounded. Surfaces reticulate except in middle of valves where ornamentation is reduced to small pits or absent; reticulation pattern parallel to anterior margin becoming

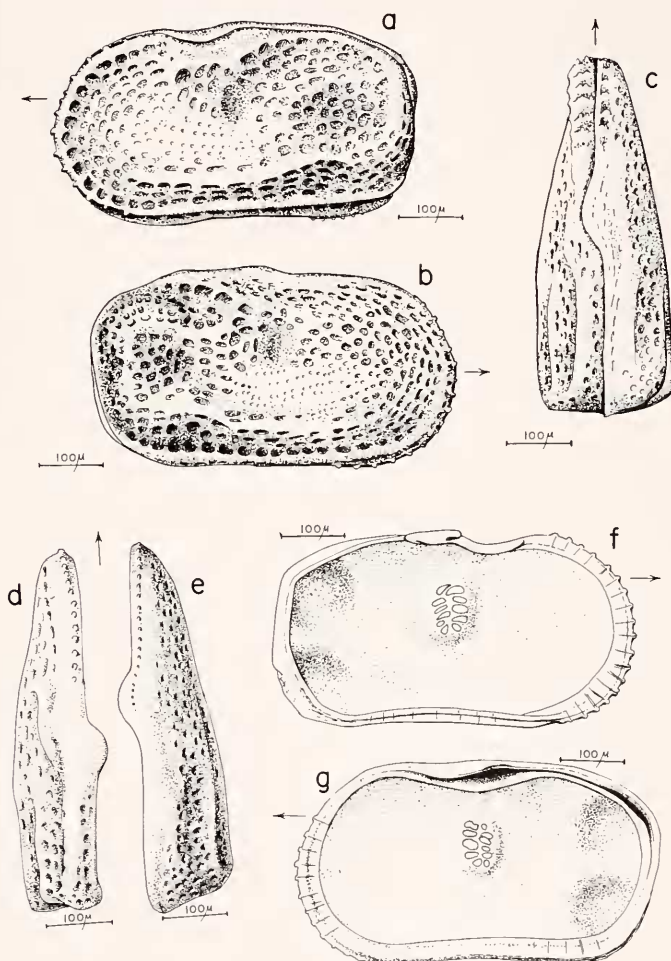


Figure 31. *Cytherelloidea praecipua* Bold, 1963, a-g, hypotype, USNM 128088; a, left valve view of adult female carapace; b, right valve view of adult female carapace; c, dorsal view of adult female carapace; d, dorsal view of adult female left valve; e, dorsal view of adult female right valve; f, interior view of adult female left valve; g, interior view of adult female right valve.

pronounced and deep behind strong anterior rim in left valve; broad undulating sulci in dorsolateral and posterolateral areas, resulting in three ridge-like swellings along dorsum, venter, and from posterior cardinal angle to center of valve beneath prominent circular dorsocentral depression corresponding to internal adductor muscle scar swelling. Two circular swellings in posterior quarter of female carapace. Right valve larger, overlapping left valve around all margins. In dorsal view: female carapace lanceolate with greatest width at truncate posterior; right valve strongly overlapping left valve just anterior to midlength with large flange-like external tooth.

Anterior duplicature broad for genus, about 40 μ at widest point, fused; 15–18 evenly spaced, simple, anterior radial pore canals passing through marginal denticles. Hinge of left valve with large flattened tooth just posterior to midlength; right valve with corresponding "socket." About 11 oblong adductor muscle scars in typical *Cytherelloidea* pattern on broad swelling in dorsal half of carapace at midlength.

Dimensions.— The collection consists of eight adult specimens of which six were entire. Lengths range from 522 to 550 μ with an average of 535 μ ; heights range from 297 to 314 μ with an average of 308 μ ; widths range from 189 to 228 μ with an average of 211 μ .

	<i>Length</i>	<i>Height</i>	<i>Width</i>
Hypotype USNM 128088. Adult left valve, sta. B-6120	538	300	189
Hypotype, USNM 128088. Adult right valve, sta. B-6120	538	304	189
Hypotype, SDNH 04248. Adult carapace, sta. B-6120	540	309	215
Hypotype, SDNH 04249. Adult carapace, sta. B-6120	533	297	209
Hypotype, SDNH 04250. Adult carapace, sta. B-6120	550	313	228
Hypotype, SDNH 04251. Penultimate carapace, sta. B-6120	477	266	156
Hypotype, SDNH 04252. Penultimate carapace, sta. B-6120	482	275	152
Hypotype, SDNH 04253. Penultimate carapace, sta. B-6120	484	273	158

Discussion.— Small differences can be noted between the Clipperton Island forms of *Cytherelloidea praecipua* and those described by Bold (1963) from Tobago and Trinidad. Bold's illustrations of the species show a more arched dorsum and concave downward venter. In addition, the left valve hinge tooth appears smaller. In all other aspects the Clipperton Island forms seem identical to those from the Caribbean.

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LITERATURE CITED

- Alexander, C. I.
1929. Ostracoda of the Cretaceous of North Texas: Texas Univ. Bull. 2907, 137 p. 10 pls.
- Apostolescu, V.
1967. Détermination des ostracodes de la Mission Singer-Polignac en Nouvelle-Calédonie: Editions de la Found. Singer-Polignac, Paris, p. 121-125, 2 pl.
- Baird, W.
1849. Arrangement of the British Entomostraca, with a list of species, particularly noticing those which have as yet been discovered within the bounds of the Club: Berwickshire Nat. Club (Hist.) Proc. (1842-1849), 2: 145-158.

1850. The natural history of the British Entomostraca. Roy. Soc. London, p. i-viii, 1-366, 36 pls.
- Belcher, E.
1843. Narrative of a voyage round the world, performed in Her Majesty's Ship "Sulphur" during the years 1836-1842. . . . Vol. 1. Colburn, London, 387 (vol. 1) and 474 (vol. 2) pp.
- Benson, R. H.
1959. Ecology of Recent ostracodes of the Todos Santos Bay region, Baja California, Mexico: Univ. Kansas Paleont. Contr., Arthropoda, art. 1:1-80, 11 pl., 20 figs.
1964. Recent marine Podocopid and Platycopid ostracodes of the Pacific: Pubbl. Staz. zool. Napoli 33, suppl.: 387-420.
- Benson, R. H. and G. L. Coleman, 11
1963. Recent marine ostracodes from the eastern Gulf of Mexico: Univ. Kansas Paleont. Contr., Arthropoda, art. 2: 1-52.
- Benson, R. H. and R. L. Kaesler
1963. Recent marine and lagoonal ostracodes from the Estero de Tastiota region, Sonora, Mexico (Northeastern Gulf of California): Univ. Kansas Paleont. Contr., Arthropoda, art. 3: 1-34.
- Bold, W. A. v. d.
1946. Contribution to the study of Ostracoda with special reference to the Tertiary and Cretaceous microfauna of the Caribbean region. Diss. Univ. Utrecht, Amsterdam, 167 p., 18 pl.
1957. Oligo-Miocene Ostracoda from southern Trinidad. Micropaleontology 3: 231-254, 4 pl., 2 figs.
1963. Upper Miocene and Pliocene Ostracoda of Trinidad. Micropaleontology 9: 361-424, 12 pl.
1966. Ostracoda from Colon Harbour, Panama. Caribbean Jour. Sci. 6(1-2): 43-64, 5 pl.
- Brady, G. S.
1866. On new or imperfectly known species of marine Ostracoda. Zool. Soc. London, Trans. 5: 359-391, pls. 57-62.
1868. A monograph of the Recent British Ostracoda. Trans. Linn. Soc., London 26: 353-495, pls. 23-41.
1870. Notes on Entomostraca taken chiefly in the Northumberland and Durham District (1869) Trans. Soc. Nat. Hist. Northumberland Durham 3: 361-373.
1880. Report on the Ostracoda dredged by the H.M.S. *Challenger* during the years 1873-1876. Rept. Voyage *Challenger*, Zool. 1 (3): 1-184, pls. 1-44.
1890. On the Ostracoda collected by G. S. Brady in the South Sea Islands. Trans. Roy. Soc. Edinburgh 35: 489-525, 4 pl.
1911. Notes on marine Ostracoda from Madeira. Proc. Zool. Soc. London 2: 595-601, pls. 20-22.
- Brady, G. S. and A. M. Norman
1889. A monograph of the marine and freshwater Ostracoda of the North Atlantic and northwestern Europe: Sect. 1. Podocopida. Trans. Roy. Dublin Soc. Sci., ser. 2, 4: 63-270, pls. 8-23.
- Briggs, J. C.
1961. The East Pacific Barrier and the distribution of marine shore fishes. Evolution 15: 545-554, 3 text fig.
- Crouch, R. W.
1949. Pliocene Ostracoda from Southern California. J. Paleon. 23: 594-599, pl. 96.
- Durham, J. W. and E. C. Allison
1960. The geologic history of Baja California and its marine faunas. Syst. Zool. 9 (2): 47-91, 7 text figs., 9 tables.
- Egger, J. G.
1901. Ostracoden aus Meeresgrund-Proben gelothet von 1874-1876 von S.M.S. Gazelle. Abh. Math-Phys. Kl. K. Bayerische Akad. Wiss. 21: 413-478, 8 pl.
- Ekman, S. P.
1953. Zoogeography of the Sea (translated from Swedish by Elizabeth Parker). Sedgwick and Jackson, London, XIV, 417 p.
- Emerson, W. K.
1967. Indo-Pacific faunal elements in the tropical eastern Pacific, with special reference to the mollusks. Venus 25: 85-93 text fig. 1
- Fergusson, G. J. and W. F. Libby
1962. UCLA radiocarbon dates I. Radiocarbon 4: 109-114.
- Fischer, S.
1855. Beiträge zur kenntnis der Ostracoden. Abh. Math.-Phys. Kl. K. Bayerische Akad. 7(3): 637-666, pls. 19-20.
- Gunther, F. J.
1967. Ostracoda of the Gulf of Panama and Bahia San Miguel. Univ. Minnesota M.S. Thesis, 204 p., 8 pl.
- Guha, D. K.
1968. On the Ostracoda from Neogene of Andaman Islands. J. Geol. Soc. India 9: 58-66, pls. 4-5.

- Hanai, T.
1957. Studies in the Ostracoda from Japan: 3, subfamilies Cytherurinae G. W. Müller (emend. G. O. Sars, 1925) and Cytheroplerinae n. subfam. J. Tokyo Univ. Fac. Sci., sec. 2(11): 11-36, pls. 2-4, 9 figs.
- Hartmann, G.
1953. *Iliocythere meyer-abichi* nov. spec., ein ostracodes des Schlickwattes von San Salvador. Zool. Anz. 151: 310-316.
1956. Zur kenntnis des Mangrove-Estero-Gebeites von El Salvador und seiner Ostracoden-fauna. Kieler Meeresforsch. 12: 219-248.
1957a. Zur kenntnis des Mangrove-Estero-Gebeites von El Salvador und seiner Ostracoden-fauna. II. Kieler Meeresforsch. 13: 134-159, pls. 39-50.
1957b. Contribucion al conocimiento de la region de estero y manglar de el Salvador y sua fauna de ostracodos, la Parte Ecologia, 2a. Parte sistematica. Sobretiro Rev. Comun. Inst. Trop. Invest. Cient. Univ. El Salvador 6: 47-108, 6 pl.
1959a. Beitrage zur kenntnis des Nicaragua-Sees unter besonderer Berücksichtigung seiner Ostracoden (mit Beschreibung von 5 neuen Arten). Zool. Anz. 162: 269-294, 9 figs.
1959b. Zur kenntnis der lotischen Lebensbereiche der pazifischen Kuste von El Salvador unter besonder er Berücksichtigung seiner Ostracoden fauna, 3, Beitrag zur Fauna el Salvador. Kieler Meeresforsch. 15: 187-241, pls. 27-48.
- Hertlein, Leo G.
1937. A note on some species of marine mollusks occurring in both Polynesia and the Western Americas. Amer. Philos. Soc. Proc. 78 (2): 303-312, pl. 1, map.
- Hertlein, Leo G. and William K. Emerson
1953. Mollusks from Clipperton Island (eastern Pacific) with the description of a new species of gastropod. San Diego Soc. Nat. Hist., Trans. 11 (13): 345-364, pl. 26-27.
- Hinte, J. E. Van
1964. A new *Occultocythereis* species of the Austrian Eocene. K. Nederlandse Akad. Wetensch., ser. B, 62: 108-115, 5 figs.
- Holden, J. C.
1964. Upper Cretaceous ostracods from California: Paleontology 7: 393-429, 28 figs.
1967. Late Cenozoic ostracodes from the drowned terraces in the Hawaiian Islands: Pacific Sci. 21: 1-50, 36 figs.
- Howe, H. V.
1951. New Tertiary ostracode fauna from Levy County, Florida. Florida Geol. Surv. Bull. 34, 43 p., 5 pls.
- Howe, H. V. and John Law
1936. Louisiana Vicksburg Oligocene Ostracoda. Dept. Conserv., Louisiana Geol. Bull. 7, 96 p., 6 pls.
- Juday, C.
1907. Ostracoda of the San Diego region. II. Littoral forms. Univ. Calif. Publs., Zool. 3: 135-358, pls. 18-20.
- Kaufmann, A.
1900. Zur Systematik der Cypriden. Mitt. Naturforsch. Ges. Bern.: 103-109.
- Key, A. J.
1953. Preliminary note on the Recent Ostracoda of the Snellius Expedition: Koninkl. Nederlandse Akad. Wetensch. Amsterdam, ser. B, 56: 155-168, 2 pls.
- Kingma, J. T.
1948. Contributions to the knowledge of the Young-Caenozoic Ostracoda from the Malayan region. Diss. Univ. Utrech, Kemink Printers, Utrecht, 119 p., 11 pls.
- Klie, W.
1938. Ostracoda, Muschelkresse. In, Dahl's Die Tierwelt Deutschland und der Angrenzenden Meeresteile, 34, 230 p.
1940. Beitrage zur Fauna der Eulitorals von Deutsch-Sudwest-Afrikas. Kieler Meeresforschungen 3: 404-448.
- Kollmann, K.
1963. Ostracoden aus der alpinen Trias II. Weitere *Bairdiidae*. Jahrb. Geol. 106: 121-203, 11 pls.
- Kornicker, L. S.
1961. Ecology and taxonomy of recent Bairdiinae (Ostracoda). Micropaleontology 7 (1): 55-70.
- Le Roy, L. W.
1943. Pleistocene and Pliocene Ostracoda of the coastal region of Southern California. J. Paleon. 17: 354-373, pls. 58-62.
1945. A contribution to ostracodal ontogeny. J. Paleon. 19: 81-86, pls. 1-25, figs. 1-2.

- Lloyd, J.
1963. Tectonic history of the south Central American orogen. In, Backbone of Americas. Amer. Assoc. Petrol. Geol. Mem. 2: 88-100.
- Maddocks, R. F.
1966. Distribution patterns of living and subfossil podocopid ostracodes in the Nosy Be area, Northern Madagascar. Univ. Kansas Paleont. Contr., Paper 12, 72 p. 63 text figs.
- McCoy, F.
1844. Synopsis of the characters of the Carboniferous fossils of Ireland (Crustacea). Dublin Univ. Press, Dublin: 159-168.
- McKenzie, K. G.
1967. The distribution of caenozoic marine Ostracoda from the Gulf of Mexico to Australia. In, Adams, C. G., and Ager, D. V., (eds). Aspects of Tethyan biogeography; a symposium. Syst. Assoc. Publ. No. 7: 219-238.
- McKenzie, K. G. and Frederick M. Swain
1967. Recent ostracoda from Scammon Lagoon, Baja California. J. Paleon. 41: 281-305, pls. 29-30.
- Morkhoven, F. P. C. M., van
1963. Post-Paleozoic Ostracoda: their morphology, taxonomy, and economic use; vol. 2. Generic descriptions. Elsevier Publ. Co., 478 p.
- Menard, H. W., and R. L. Fisher
1958. Clipperton Fracture Zone in the northeast equatorial Pacific. J. Geol. 66: 239-253, 1 pl., 8 text figs.
- Müller, G. W.
1894. Die Ostracoden des Golfes von Neapel und der Angrenzenden Meeres-Abschnitte. In, Fauna and Flora des Golfes von Neapel und der Angrenzenden Meeres-Abschnitte, Monogr. 21: 404, 40 pls.
1912. Ostracoda. In, Das Tierreich. Eine Zusammenstellung und kennzeichnung der rezenten Tierformen Im Auftrage der K. Preuss. Akad. Berlin 31: 1-434, 92 figs.
- Müller, O. F.
1776. Zoologiae Danicae prodromus, seu animalium Daniae et Norvegiae indigenarum charateres, nomina et synonyma imprimis popularium. Hallager, Copenhagen: 1-282.
- Neviani, A.
1928. Ostracodi fossili d'Italia, I. Vallebajaja (Calabrino). Mem. Pont. Sci., Nuovi Lincei, ser. 2, 11, 120 p., 21 pls.
- Puri, H. S.
1953. The ostracode genus *Hemicythere* and its allies. Washington Acad. Sci., J. 43(6): 169-179, pls. 1-2.
1960. Recent Ostracoda from the west coast of Florida. Gulf Coast Assoc. Geol. Soc., Trans. 10: 107-149, 6 pls., 46 figs.
- Reyment, R. A.
1964. Notes on an upper salinity tolerance level for *Cypridopsis* (Ostracoda). Crustaceana 7: 76-77.
- Rothwell, W. T.
1948a. Distribution of living ostracodes, Newport Bay, California. Geol. Soc. Amer., Bull. 59: 1380-1381 (abst.).
1948b. Paleocological interpretations from ostracodes: Geol. Soc. Amer., Bull. 59: 1381 (abst.).
- Sachet, M.
1960. Histoire de l'île Clipperton. Cahiers du Pacifique 2: 3-32, 1 pl., 1 text fig.
1962a. Flora and vegetation of Clipperton Island. California Acad. Sci., Proc., ser. 4, 31 (10): 249-307, 12 text figs., 1 table, 1 map.
1962b. Geography and land ecology of Clipperton Island. Atoll Res. Bull. 86 (III), 115 p., 4 text figs., 5 tables.
1962c. Monographie physique et biologique d'île Clipperton. Ann. Inst. Océanogr. (Paris), 40 (1): 107 p., 12 pls., 3 text figs., 3 tables.
1963. History of change in the biota of Clipperton Island. In, Pacific Basin biogeography (symposium, ed. J. L. Gressitt). Bernice P. Bishop Mus. Press: 525-534.
- Sars, G. O.
1866. Oversight of Norges marine ostracoder. Forhandl. Vidensk. Selsk. Christiana 7: 1-130.
1888. Nye Bidrag til Kundskaben om Middelhavets Invertebratfauna: IV Ostracoda Mediterranea. Archiv. Math. Naturw. 12: 173-324, pls. 1-20.
- Sars, G. O.
1926. An account of the Crustacea of Norway, Cytheridae (cont.). Bergen Mus., Norway, pts. 13-14: 209-240, pls. 97-112.
- Skogsberg, T.
1928. Studies on marine ostracodes. Part. 2. External morphology of the genus *Cythereis* and descriptions

- of twenty-one new species. *Occas. Papers, California Acad. Sci.* 15: 1-144.
1950. Two new species of marine Ostracoda (Podocopa) from California: *Proc. California Acad. Sci.*, ser. 4, 26: 483-505, pls. 27-30.
- Sverdrup, H. V., Martin W. Johnson, and Richard H. Fleming
1942. The oceans, their physics, chemistry, and general biology. Prentice-Hall, Inc., x + 1027 p.
- Swain, M.
1967. Ostracoda from the Gulf of California. *Geol. Soc. America, Memoir* 101, 139 p.
- Swain, M. and J. M. Gilby
1964. Ecology and taxonomy of Ostracoda and an alga from Lake Nicaragua. *Pubbl. Staz. zool. Napoli* 33 (suppl.): 361-386, 4 pls.
- Swain, W. and F. J. Gunther
1969. Recent ostracoda from San Juan del Sur, Nicaragua, and their relationship to other ostracode populations of western Central America. *Inst. Centroamericano Invest. Tech. Indust. (Guatemala, C. A.), Trabajos Technicos Presentados en la segundo Reunion de Geologos de America Central Publ. Geol. I.C.A.I.T.I.* 2: 54-55, 1 table (abst.).
- Sylvester-Bradley, P. C.
1948. The ostracode genus *Cythereis*. *J. Paleont.* 22(6): 792-797, pl. 122.
- Teeter, W. T.
1966. The distribution of Recent marine ostracodes from British Honduras. Ph.D. thesis, Rice University, Houston, Texas, 212 p., 19 pls.
- Tressler, W. L.
1941. Ostracoda, part 4, of *Geology and Biology of North Atlantic deep-sea cores between Newfoundland and Ireland*. U.S. Geol. Surv. Prof. Paper 196-C: 95-106, pls. 18-19.
- Triebel, E.
1948. Zur Kenntnis der Ostracoden-Gattung *Triebelina*. *Senckenbergiana* 29: 17-22.
1954. *Loxoconchella* n. g. (Crust., ostr.): *Senckenbergiana Lethaea* 35: 17-21, 2 pls.
1956. Brackwasser-ostracoden von den Galapagos-Inseln: *Senckenbergiana Biol.* 37: 447-467, pls. 54-58.
1957. Neue Ostracoden aus dem Pleistozan von Kalifornien: *Senckenbergiana Lethaea* 38: 291-309, pls. 1-5.
1960. Die taxonomische Stellung und die Gattungen der Unterfamilie Macrocypridinae (Ostracoda): *Senckenbergiana Biol.* 44: 109-124, pls. 13-20.
1961. Geschlechts-dimorphismus und asymmetrie der klappen bei der ostracodengattung *Occultocythereis*: *Senckenbergiana Lethaea* 42: 205-225, 5 pls.
- U. S. Navy Hydrographic Office
1947. Atlas of surface currents, northeastern Pacific Ocean. Hydrographic Office Publ. 570, 12 sheets.
1950. Atlas of surface currents, northwestern Pacific Ocean. Hydrographic Office Publ. 569, 12 sheets.
1966. Atlas of pilot charts, South Pacific and Indian Oceans, Third Edition. Hydrographic Publ. 107.
- Wagner, C. W.
1957. Sur les ostracodes du quaternaire recent des Pas-Bas et leur utilisation dans l'etude geologique des depots holocenes. Mouton and Co., The Hague, 158 p. 40 pls.
- Wyrski, K.
1965. Oceanography of the eastern equatorial Pacific Ocean. *Oceanogr. Mar. Biol. Ann. Rev.* 4: 33-68.

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